February 2015

TECHNOLOGY

Asian Outlook on Engineering and Technology

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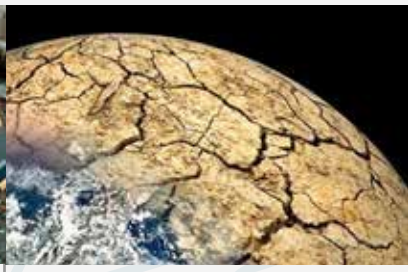

In This Issue

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Editorial

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DEAR READER

Achieving disaster resilience is an objective that is proving to be challenging for many, especially for developing countries located in regions that are prone to volcanic eruptions, earthquakes, tsunamis, storms, tropical cyclones, landslides, and floods. Not even the world's arguably most disaster-prepared countries stand a chance against the undersea mega thrust tsunamis, major cyclones, and hurricanes.

This issue presents several initiatives, propositions, and experiences that our community may find great value in. We begin by looking into the recent advances in earthquake predictions, written by one of the leading authorities in earthquake engineering, Prof. Shunji Murai. My esteemed colleagues will then take you through their contributions to the field of disaster resilience from different perspectives such as remote-sensing, water resources engineering, environments, public health, and capacity building. There is much to learn from this issue's authors, as they present their findings from varying parts of the world; from the changing skyline of Manila to the shifting seasons in Kathmandu, the unexpected learnings for Afghanistan from the Aral Sea and the Colorado River, to the rice paddies in the northeast of Thailand, to name a few.

I hope that the ideas shared in this issue will be valuable to all readers and instigate discussions and promote cooperation as we work together to strive to achieve resilience to various natural disasters. My gratitude extends to all the contributors for their tireless efforts to make this issue full of useful information to all practitioners dedicated to building disaster-resilient communities.

I would like to extend my sincerest invitation to join our team in developing the next issue of TECHNOLOGY magazine by sending us your feedback, contributing your own articles, achievements, and opinions on matters relevant to the sustainable development of our world.

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Recent Successes in Earthquake Predictions in Japan

By Shunji Murai

A new approach for the earthquake prediction using daily data from the Global Navigation Satellite System (GNSS) observed by 1,300 GNSS-based control stations all over Japan is making waves and headlines. This approach was developed by a pioneering group of scientists who have been working on the method since 2002.

Source: *UK News*

Recent Successes in Earthquake Predictions in Japan

Author:

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Advisor, Japan Earthquake Science Exploration Agency (JESEA)

A new approach for the earthquake prediction using daily data from the Global Navigation Satellite System (GNSS) observed by 1,300 GNSS-based control stations all over Japan is making waves and headlines. This approach was developed by a pioneering group of scientists who have been working on the method since 2002. Eight earthquakes occurred so far in 2014 with larger than Japan Meteorological Agency's (JMA) seismic intensity scale 5 that were predicted successfully with the newly developed prediction method. Japan Earthquake Science Exploration Agency (JESEA) started its official efforts in earthquake prediction in February 2013, attracting more than 30,000 individual members who regularly receive weekly MEGA earthquake predictions. Due to the success of JESEA's predictions, several TV programs and magazines have reported the agency's achievements since May 2013.

Sources: NBC News, The Guardian

North Nagano Prefecture Earthquake

Global Navigation Satellite System (GNSS) is a satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world. Satellite-based navigation systems use a version of triangulation to locate the user, through calculations involving information from a number of satellites. Each satellite transmits coded signals at precise intervals. The receiver converts signal information into position, velocity, and time estimates. Using this information, any receiver on or near the earth's surface can calculate the exact position of the transmitting satellite and the distance (from the transmission time delay) between it and the receiver. Coordinating current signal data from four or more satellites enables the receiver to determine its position.

New Methods of Earthquake Prediction

Though the methods were relatively simple with the analysis of the daily data (a week data) observed at 1,300 GNSS stations and released every Monday by the Geospatial Information Authority (GSI).

JESEA developed and currently uses the following methods:

- Weekly change: the change between the maximum and minimum height to be automatically checked to determine whether the change exceeds the threshold or not.
- Two-year trend: the abnormal rising or sinking to be automatically checked.
- Six-month accumulated deformation: accumulated value of rising or sinking to be automatically checked.

The above indices will then be represented in graph or map with respect to the prefecture category or all Japan. After checking the graphs and maps, careful interpretation for the prediction is executed. Professional experience and knowledge would be necessary for the prediction. Every word in the prediction document should be based on scientific back data or graphic representation.

Achievement of Predictions

Several cases of larger earthquakes occurred in 2014 are introduced hereafter together with the warning used in the mail magazine served to the individual members.

North Nagano Prefecture Earthquake

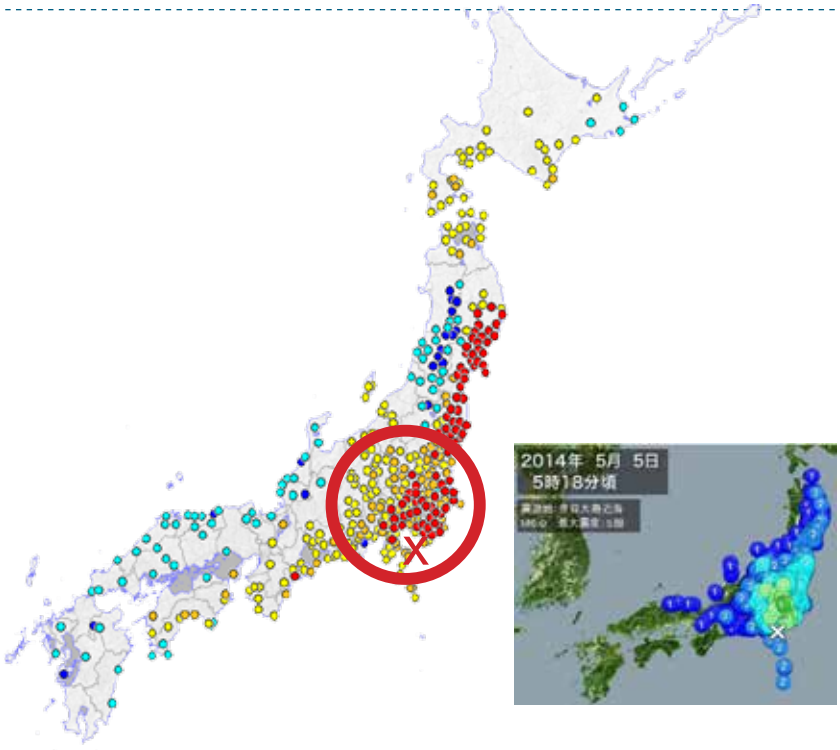
This earthquake occurred on the 22 November 2014 with magnitude of 6.7 and a Japan Meteorological Agency (JMA) scale of 6-. None died but about 30 houses were completely destroyed and about 60 houses were partially destroyed with about 50 persons injured. The first warning was made in the end of February 2014, reporting abnormal weekly height changes around the Nagano Prefecture area. In the beginning of May up to September 2014, the warning was upgraded to serious status as small earthquakes occurred more frequently near the area. Because a large earthquake occurred at the east end of the area in September and also Mt. Ontake Volcano erupted on the 27 September, the warning level was downgraded as careful status. But when a large earthquake occurred on the 22 November, the weekly magazine "Weekly Post" issued on the 8 September then reported the serious status of the area with a risk map. The prediction was treated as a successful case, which was reported in the weekly magazine issued on 1 December 2014.

Oshima Offshore Earthquake

This disaster occurred on the 5 May 2014 with a magnitude of 6.0 and JMA scale of 5-. Though the epicenter was near the Oshima Island, located south of Tokyo Bay, the most seriously affected area was Chiyoda Ward in central Tokyo. Since the depth of the epicenter was 160 km under the ground, the weekly height changes and two-year trend did not provide any pre-signals except only in the accumulated deformation. Figure 1 shows the abnormal signals in the accumulated deformation shown in a red circle. The image was reported to the JESEA members in the end of March 2014. From the beginning of April, JESEA began to warn the public of the possibility of earthquake in Tokyo area. It was about a month after the warning when the actual earthquake occurred.

Iyo-nada Earthquake

This earthquake occurred on the 14 March 2014 with a magnitude of 6.2 and JMA scale 5+. The pre-signals of the abnormal weekly height changes were identified in September and October 2013 and January 2014. JESEA started warning in October and continued providing detailed information for 13 weeks until the earthquake occurred. On the 9 March, a local Fiji TV program invited the leading expert to provide more clarity about this issue. It was then reported that a big earthquake would occur around Kyushu and Shikoku area (the epicenter of Iyonada included) within March. Five days after the TV program was broadcasted on the 9 March, the Iyo-nada Earthquake occurred on the 14 March. The precision of the predictions resulted in the drastic increase of subscriptions of individual members with 2,000 up to 10,000 applying for forecasts within a week.



Oshima Offshore Earthquake

Figure 1: *Abnormal distribution of accumulated deformation in Tokyo Area. The epicenter, Oshima Island, is marked with an X but did not quake unlike central Tokyo which was affected seriously as shown in the figure on the right.*

Iyo-nada Earthquake

Sources: Houston News

Unlocking the Future Potential of GNSS

JESEA succeeded in the scientific prediction of earthquakes using GNSS data based on the time accuracy from the pre-signals until the occurrence of the corresponding earthquake with variations proving to be not very high, ranging from a few weeks to a few months. Though the governmental and academic organizations have yet to fully accept this new methodology, more than 30,000 individuals have already subscribed to receive the predictions from JESEA and this number is expected to increase in the coming months given the reported precision of the application of GNSS data.

UPCOMING EVENT

HOUSING FOR ALL: Innovative Solutions

October 2015

AIT Consulting in collaboration with other innovative solution partners is organizing a two-day event in Bangkok on the theme **"Housing for All: Innovative Solutions"** later this year. This event will cover many aspects related to overcoming the housing challenges for providing affordable housing in many countries all over the world.

Rapid urbanization and increasing costs has made it extremely difficult for people with low income to afford and live in decent and healthy living spaces especially in urban and sub-urban areas. Lack of appropriate technologies to build sustainable and eco-friendly homes at an affordable price and appropriate mechanisms to create financial viability contributes to the increasing challenge.

In order to overcome some of these major challenges, AIT Consulting is organizing this event where a panel of key experts will present integrated and comprehensive solutions including financial and business models, suitable technologies and innovative ideas such that some of these challenges may be addressed. This event will be attended by government bodies, housing authorities and policymakers, INGOs and funding agencies, development agencies, real estate and private construction companies, financial institutions, engineers, architects, and other universities in the region.

The event will also showcase an exhibition of related products, services and appropriate technologies for providing affordable housing solutions.

Tentative Themes

1. Livability
2. Disaster Resilience
3. Environmental Sustainability
4. Construction Technologies
5. Reducing Costs
6. Increasing Affordability
7. Business and Commercial Viability
8. Social and Community aspects
9. Facility Management

STUDENT COMPETITION

Students from universities in Asia are invited to participate during this event. They will be challenged to develop innovative and appropriate solutions to address providing housing for all. Selected finalists will then prepare a presentation on their topic to be delivered during the event dates.

Competition Topics

- Financial models
- Innovative construction technology to build affordable housing
- Business model for providing affordable housing

For more information, visit: ***www.consulting.ait.asia***

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Increasing Disaster Resilience for Nepal's School Sector

By Naveed Anwar

Due to Nepal's susceptibility to natural disasters, the loss of human, economic, and education facilities after a strong event will be of an enormous scale. By increasing the disaster resilience of schools and its infrastructure, these consequences can be averted or reduced significantly.

Increasing Disaster Resilience for Nepal's School Sector

Nepal is located in a high hazard zone with high vulnerabilities and exposure, leading to potentially high risk and grave consequences from natural disasters, especially from earthquakes. The country lies on several active faults where possible epicenters are located at rather shallow depths, increasing the probability of Nepal experiencing very strong ground motions.

Due to the growing understanding of the importance of disaster resilience (DR) in Nepal, many programs have been initiated in many sectors, including the establishment of National Risk Reduction Consortium (NRRC), comprising of five flagship programs.

School and Hospital Safety. Led by the Asian Development Bank (ADB), World Health Organization (WHO), and Nepal's Ministry of Education (MOE) and Ministry of Health (MOH), it aims to build the earthquake resilience of schools and hospitals through retrofitting, training, raising awareness, and safety measures.

Emergency Preparedness and Response. Led by UNOCHA and Nepal's Ministry of Home Affairs (MOHA), it seeks to enhance the government's preparedness and response capabilities at the national, regional, and local level.

Flood Risk Management in Koshi River Basin. Led by the World Bank (WB) and Nepal's Ministry of Irrigation, this initiative aims to protect the country from flood-related disasters.

Community-based Disaster Risk Management. Led by the International Federation of Red Cross/Red Crescent Societies and Nepal's Ministry of Local Development, this effort aims to prepare 1000 VDCs to become disaster resilient.

Policy/Institutional Strengthening. The United Nations Development Program and Nepal's Ministry of Home Affairs lead with the aim of enhancing government's disaster risk management capacity centrally and at the municipal and local level.

Administrative, Geographical, and Ecological Regions of Nepal

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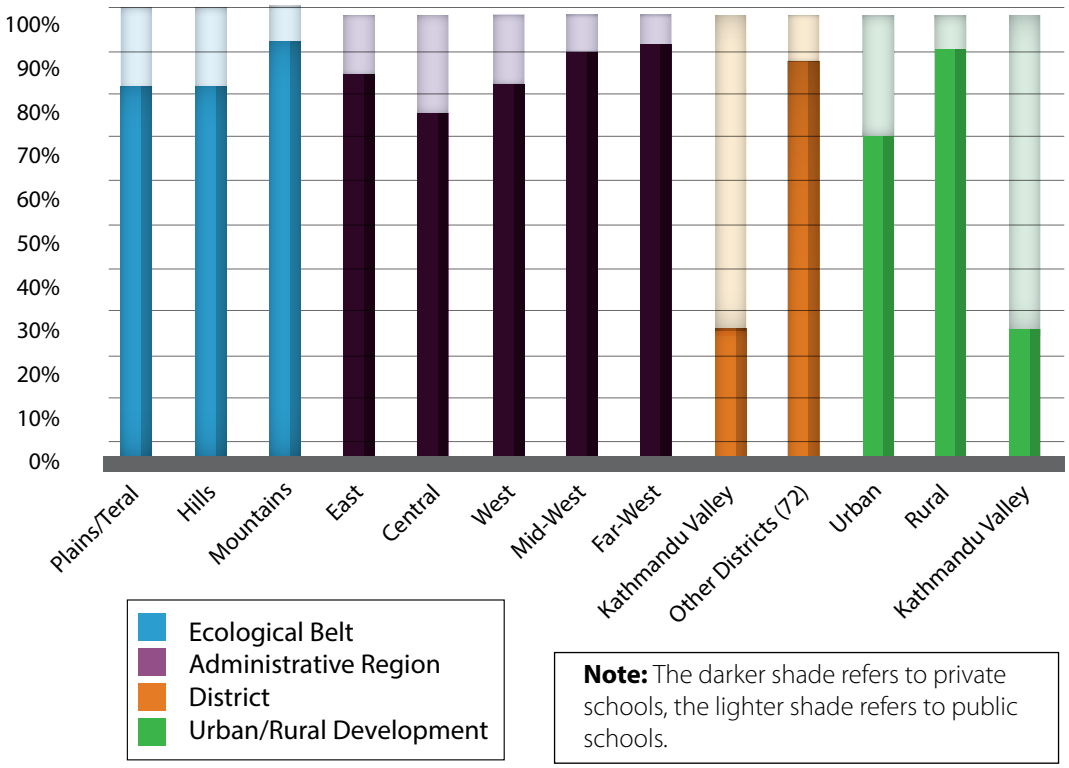
One such program is the School Safety Program (SSP) which was initiated and is being funded by the Asian Development Bank (ADB) and the Australian Agency for International Development under the Flagship 1 of the NRRC. As a Technical Assistance Program, SSP is being implemented through Nepal's Department of Education (DOE), under the Ministry of Education (MOE) which is the government agency responsible also for the school sector. This program initially targeted about 260 public school buildings in Kathmandu Valley (KV) for retrofitting to increase resilience to earthquakes. SSP also included capacity building programs for masons, teachers, students, and professionals in the DOE within a 2-year duration starting from 2012. Many of these activities have been successfully completed to date.

Even though SSP covers less than 0.3% of total scope of schools in the country, and is only administered in KV, it has helped to identify several challenges, such as the lack of capacity and resources, need for better technological solutions, quality assurance, financial management, reconsideration of the role of community, and coordination amongst various stakeholders. Tackling the disaster risk reduction (DRR) activities in the entire country with a scale that is 300 times larger, spread over 75 districts, needs a clear strategy and plan. Streamlining existing processes and developing innovative ways to increase and sustain DR is the key to accomplishing scaling up.



School Distribution-based on Four Categorizations: Ecological Belt, Administrative Region, District, and Urban/Rural Development

The School Sector Reform Plan 2009-2015 (SSRP) is another key project of MOE which serves as the basis for most of the improvements and modifications in the school sector. Reports showed minimal issues in implementation and that most of the district-level programs were observed to be satisfactory. The SSRP is considered a potential platform for integration with SSP and for scaling up the DR initiatives.

The specific challenges identified is summarized as the need to address the shortage of resources, increased capacity building in various actors, appropriate budget allocation and financial approval systems, cost-effective retrofitting solutions, and improved focus on quality assurance, coordination, and management. These challenges can be summarized as:

Scale and Complexity	The scale and complexity in terms of the number of schools, their geographical and regional distribution, and the number of the stakeholders involved.
Political	Need for reinforcement of will at the top levels, the commitment to this will, assigning a high priority, making of appropriate policies and legislations, and continuity until the objectives are achieved.
Governance	Strengthening the appropriate frameworks and organizational structures to handle this task.
Legal	Need of sufficient and appropriate legal frameworks based on the policies and regulations, and corresponding enforcements.
Financial	Need of financial resources for undertaking the scaled up tasks, the integration of the DRR activities in appropriate budgets, the possible misuse of funds, and delays in realization of the allocated funds.
Technical	Need for greater ability and capacity to handle planning and design aspects, lack of intervention technologies, QE/QA/QC issues, and lack of relevant research.
Management	Lack of capacity, frameworks, and mechanisms for all aspects related to management, coordination, reporting, monitoring, and evaluation.
Social	Not enough public awareness on the significance of DRR, lack of acceptance of the intervention solutions, low/inadequate community contributions.

Increasing DR in Schools: Overall Strategies and Actions

Recognizing and supporting the several ongoing and planned initiatives and programs related to DRR in Nepal, and to ensure an increased effectiveness and reduced instances of duplicated efforts and emphasize focus on DR of schools, the strategies are divided into two categories; Linked and Stand-alone.

Linked strategies refer to those that have relationships, ownership, and/or relevance to the National DRR initiatives, but will also impact the DR of the school sector. These strategies are either based on strengthening and supporting other ongoing and planned initiatives or needs integration with them.

Six strategies are proposed under this category:

1. Increased DR awareness in various stakeholders, at various levels.
2. Continuous reinforcement of will and commitment to DR at the highest levels of the government and development partners.
3. Increased institutionalization and coordination to tackle the risks and consequences of various disasters.
4. Building overall capability and capacity of different stakeholders for DRR.
5. Facilitate and support local research to aid in providing relevant solutions for measures leading to DRR.
6. Development and/or amendment of policies, acts, and regulations, and their enforcement for enabling implementation of various strategies, actions and measures aimed at DRR of various sectors, including the schools.

Stand-alone strategies are specific strategies that are primarily applicable to the school sector and can be implemented mostly independently within the defined frameworks. These consist of the following nine strategies:

1. Building competency-based capability and capacity of the agencies directly involved in the implementation of the DRR process.
2. Classification, categorization, and standardization of the intervention solutions for the vast scale of schools and buildings capitalizing on the geographical, administrative, rural/urban, building materials, and size variations.
3. Prioritized increase in multi-hazard DR for public schools, based on the disaster consequences as the primary parameter derived from hazard levels, vulnerability, and exposure, using a combination of one-time and incremental safety approaches.
4. Increased DR of private schools through a combination of appropriate regulations, licensing, certification, technical and administrative support, and incentives, in close collaboration with private sector.
5. Integration of DR into SSRP and other related development plans for maximizing the cost and resource effectiveness, and to avoid duplication and conflicting interventions.
6. Certification of the DRR process and the final outcome, through continuous quality assurance mechanisms and formal inspections, combined with voluntary DR rating.
7. Increased community DR through systematic and assured involvement of the community in awareness, capacity building, intervention implementation, monitoring the final outcome of increased school DR.
8. Integration of various aspects of DR into the academic and professional curricula, progressively from basic awareness to vocational training and advanced knowledge and skill sets.
9. Implementation of results-based monitoring and evaluation performance management plans to ensure the achievement of the outputs and outcomes.

The scale and complexity of the tasks require the engagement of many stakeholders carefully aligned with appropriate linkages for a strong and flexible framework that is necessary for the implementation of the DR strategies at a national level.

Choosing between Rebuild and Retrofit:

When deciding whether to retrofit or rebuild, the following strategy and considerations are important:

- All historical, monumental, or national heritage buildings must be considered as special cases by the Technical Advisory Committee (TAC).
- A purely on cost basis following criteria is recommended in order to consider the overall benefits of the investment. In essence, older vulnerable buildings should be considered for re-build, as it will not only improve DR but also the functionality, and possibly land and/or space utilization. Newer vulnerable buildings should be preferred for retrofit, even at a higher relative cost.
- While computing rebuilding cost, the savings due to possible re-use of material from existing buildings should be considered.

General considerations based on the age and vulnerability of selected buildings are outlined below:

10 year old buildings that are very vulnerable	Up to 70% of the new building cost may be allowed for retrofitting; if more than 70% is required, then consider new construction
10-20 year old buildings with high vulnerability	50-70% of the new building cost may be allowed for retrofitting, if more than 70% is required, then consider new construction
20-40 year old buildings	20-50% of the new building cost may be allowed for retrofitting, if more than 50% is required, then consider new construction
40+ year old buildings	New construction is preferred unless the retrofit cost is less than 20%

Working Together: Ownership, Implementation, and Coordination

The scale and complexity of the tasks require the engagement of many stakeholders carefully aligned with appropriate linkages for a strong and flexible framework that is necessary for the implementation of the DR strategies at a national level. To address this, a thorough review was performed. A coordination framework largely reinforced by a collective agreement for the MOE through the DOE, to take ownership of the entire program as the primary implementing and coordinating agency, actively supported by the Department of Urban Development (DUDBC) under the Ministry of Urban Development (MOUD). Frequent and smooth coordination with other ministries and the Office of the Prime Minister will help ensure that the objectives of this program are met.

Due to the level of community participation that is prevalent in Nepal, it is also proposed to reconsider the roles for community participation in the school DRR process. The roles can promote ownership by the community's inclusion in basic training programs and thereby equipping the community with skills in order to respond to various hazards and disasters. The community may also be involved in fundraising and generating other in-kind resources and services related to the process, direct intervention (construction) activities, and monitoring the works carried out by other parties, together with the district education office (DEO), village development committees (VDCs), and consultants.

A separate, dedicated coordination office is proposed for the coordination of the entire school DRR process. This office will function as a clearing house and repository of all information generated and needed to smoothly carry out various aspects of the overall process, and will coordinate with various government agencies, development partners, UN agencies, INGOS/ NGOS, private school operators, technical committees, the media, and other stakeholders.

What is Needed: The Plan

Prioritization

Considering the large scale of the intervention, it is important to prioritize the tasks and schools identified for intervention, so that the finances and resources can be allocated efficiently and utilized effectively. Three levels of prioritization are considered:

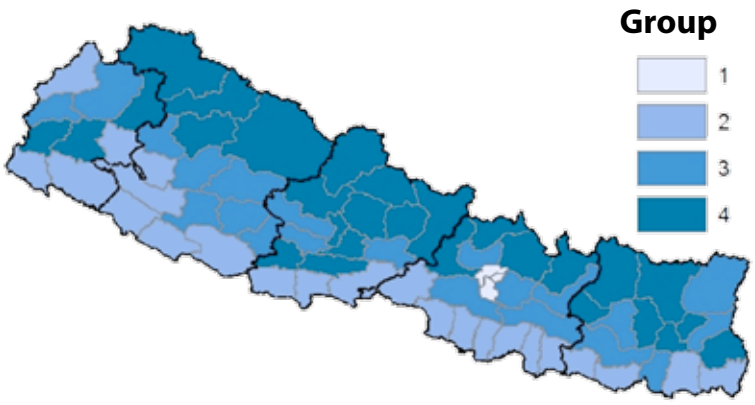
a. High priority tasks, without which the DRR process cannot be initiated. This includes generation of detailed school and building inventory for all schools in the country, formulation of policies, conducting/obtaining risk assessment studies, development of design criteria and guidelines, classifications and categorizations, and development of standardized solutions.

b. A macro-level (district) priority grouping for the implementation of the DRR process which is primarily based on the anticipated disaster consequences. This is done by assuming that the vulnerability of the buildings is of similar order in all districts, and therefore considering the hazard levels, student density per classroom, population density of the district, and the overall conditions of the buildings as the main parameters. This prioritization is done with a view to gain maximum benefit from the intervention.

c. A local-level prioritization of the individual schools and buildings, within the districts, based on detailed assessments, and considering other relevant factors. This is to be done at the implementation stage, and is not considered in the current plan.

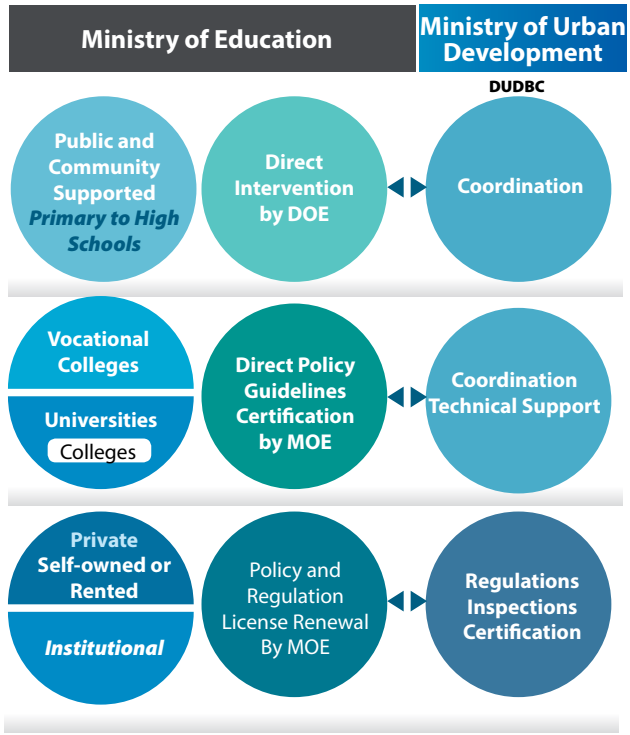
Four district-level priority groups have been initially planned based on the available data. This grouping should be re-evaluated once the basic school inventory is completed for the entire country. The categorized groups, number of districts in each group, number of students in public schools that will benefit from the intervention are presented below, together with associated cost:

Group-1	3 Districts of KV	151,385 Students
Group-2	23 Districts	3,055,830 Students
Group-3	21 Districts	1,701,777 Students
Group-4	28 Districts	1,284,020 Students



Priority Groups Distribution, by District

It is very important to note, that for KV, more than 70% of the students are in the private schools (about 3 times more of those enrolled in public schools). The focus of priority Group-1 must on private schools, in addition to the ongoing and future plans for public schools.



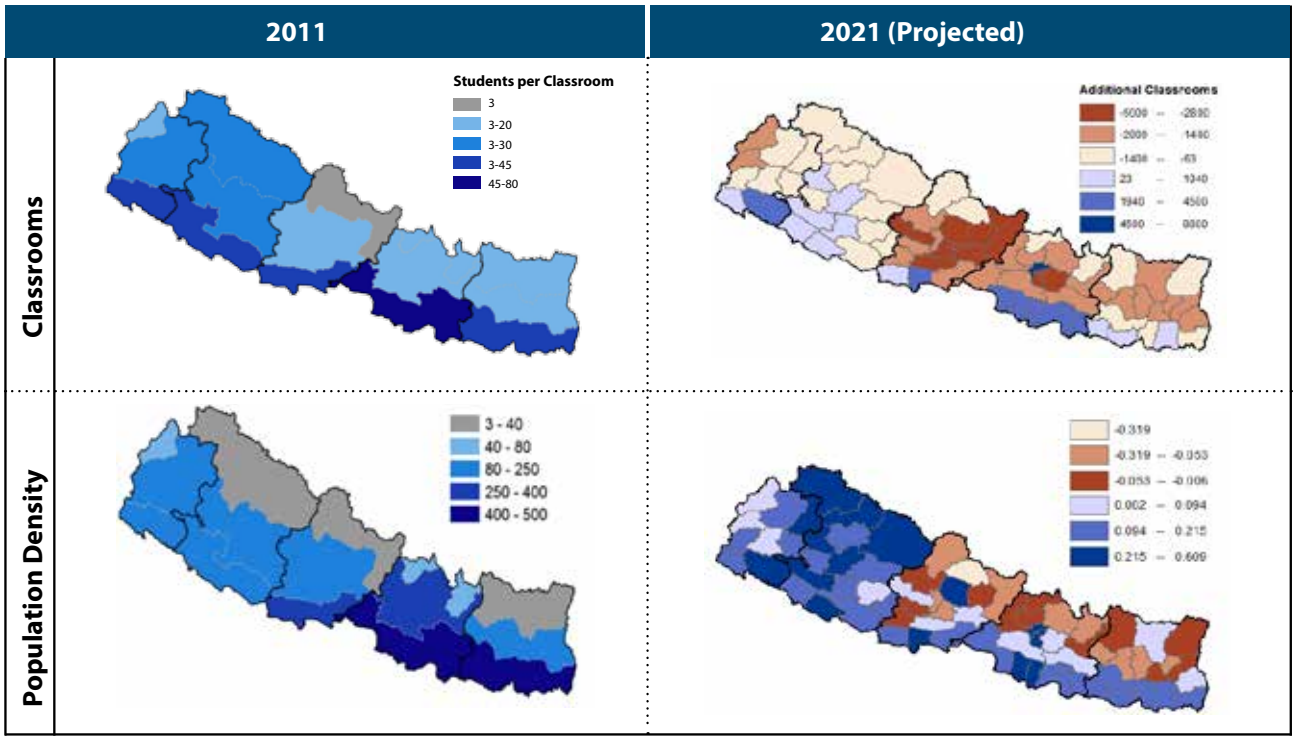
Conceptual Framework for Sharing DR Responsibility

Resources

The primary resources needed for implementation are from DOE, DUDBC, DEOs, consultants, contractors, and coordination office; whereas the supporting resources required are Technical Advisory Committee, Development Partners, UN Agencies, INGOs, and NGOs.

The average number of estimated resources required during the execution and implementation of the prioritized plan, over a period about 8 to 10 years have been calculated to the proponents of the program.

A significantly large number of staff was estimated to be increased in DOE, DEO, and DUDBC to support the large-scale implementation. The involvement of international firms will be essential to supplement and support the local capacity in cases when consultants and construction firms may not be available to undertake the implementation tasks.



Comparison of Students per Classrooms and Population Density for 2011 and 2021

Finances

The cost to implement this program is estimated to be equivalent to about 8,000 NPR (roughly 80 USD), per student enrolled in the school system. This means the safety of nearly all children (enrolled in schools) from natural disasters can be significantly improved/ensured by spending about 10 USD, per child, per year for the next 8 years on school DRR. This is equivalent to less than 1 USD per month per child. This includes the finances needed by DOE and DUDBC to implement the strategy proposed for the private schools. A total 55,725 Million NPR (approximately 560 Million USD) may be needed for completing the DRR of all public schools in the country, in about 8 to 10 years duration.

Additional cost may be incurred by the various ministries, development partners, UN agencies, NGOs, various professional organizations, academic institutes, and committees that support the overall DRR process were not explicitly included in this estimates. It is likely that these incidentals will be covered as part of the commitment of these organizations to the cause.

Increased School Sector Resilience to Disasters, A Priority and Necessity

School buildings and the surrounding premises are prone to particularly high risks due to the large number of students studying in relatively small, inappropriately designed and constructed buildings. Due to Nepal's susceptibility to natural disasters, the loss of human, economic, and education facilities after a strong event will be of an enormous scale. By increasing the DR of schools and its infrastructure, these consequences can be averted or reduced significantly. These buildings can also provide the much needed immediate shelters and temporary relief centers for the surrounding communities, which are equally or even more vulnerable.

The scale and complexity of the tasks require the engagement of many stakeholders carefully aligned with appropriate linkages for a strong and flexible framework necessary to implement DR strategies at a national level.

On New Schools

In planning for the constructing new schools, an average of 35 students per classroom was projected for each district for all schools (public and private). Results show that by 2021, approximately 45,000 new classrooms must be constructed to satisfy the projected demand in Nepal. Given that an estimated 20% of the new classrooms will be private, a total of 36,000 new public classrooms will need to be constructed by 2021 in Nepal.

For the hilly and mountainous areas that are sparsely populated, innovative solutions such as adopting an Education Village concept may prove to increase occupancy rate in the classrooms by reducing the student's travel from daily to weekly, increase mobilization effectiveness, and maximize the utilization of resources. An Education Village will essentially transform underutilized school infrastructures, with the possibility to merge with other schools, to provide both academic and lodging facilities to students.

The plan and strategy outlined for the school sector of Nepal were partial results of the project, Capacity Development for School Sector Program Implementation (TA 7935 NEP) ***Contract Number: 106698-S79855****, awarded by the Asian Development Bank to the author.*

Applications of Remote Sensing in Post-Disaster Management

By Manzul Kumar Hazarika

In recent years, more and more remote sensing satellites are becoming available and this has made it possible to acquire satellite images of a disaster-affected area immediately after a disaster event. An initiative called Sentinel Asia was launched in 2005 by a few space agencies of Asia serving 25 countries in Asia.

Source: *Fabbrica Ambiente*

Applications of Remote Sensing in Post-Disaster Management

In recent years, more and more remote sensing satellites are becoming available and this has made it possible to acquire satellite images of a disaster-affected area immediately after a disaster event. To this effect, an initiative called Sentinel Asia was launched in 2005 by a few space agencies of Asia. As of today, the Sentinel Asia serves 25 countries in Asia through the Asian Disaster Reduction Center (ADRC). In an event of a disaster, a request to acquire satellite images can be sent to the designated space agencies, known as Data Provider Node (DPN), through ADRC and the acquired data are immediately made available to the a designated agencies in the countries, known as Data Analysis Node (DAN), as well as to the Geoinformatics Center of the Asian Institute of Technology (AIT), which is known as the Principal Data Analysis Node (P-DAN). As a P-DAN, the Geoinformatics Center helps the countries not only in processing of the acquired data but also to coordinate with them when preparing value-added products for response activities in a disaster affected country.

Sentinel Asia Initiative

The Sentinel Asia initiative has been a voluntary and best-efforts-based collaboration between regional space agencies and disaster management agencies for an effective disaster management in the Asia-Pacific region through applications of Remote Sensing (RS), Geographic Information System (GIS), and WebGIS technologies. Sentinel Asia closely works with the International Charter 'Space and Major Disasters' and provides countries a gateway to the International Charter, which allows countries in the region to request satellite images from the satellite operators beyond Asia in case of a catastrophic disaster, regardless of their membership to the International Charter.

Established in 2005, Sentinel Asia (SA) initiative acquire satellite images and provide value-added products to a disaster affected country for emergency response purpose during a major disaster event and it aims to: 1) enhance safety in society, through more efficient use of internet and other data distribution systems, as well as easier access to space technologies provided by countries in the region, 2) improve the speed and accuracy of disaster preparedness and early warning systems, and 3) minimize the number of victims and economic losses.

Data Provider and Data Analysis Nodes

Data Provider Node (DPN) is the space agencies that own satellites to make emergency observations at the time of a disaster and provide the data to Data Analysis Nodes (DAN). DAN assists in the processing of satellite data provided by DPNs and prepare value-added products to provide to the disaster management agencies and other stakeholders in a disaster-affected country.

DPN members are the Japan Aerospace Exploration Agency (JAXA), Japan; the Indian Space Research Organization (ISRO), India; the Korea Aerospace Research Institute (KARI), South Korea; the Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand; the National Applied Research Laboratories (NARL), Taiwan; and the Center for Remote Imaging, Sensing and Processing (CRISP), Singapore.

In the case of an emergency observation, the DAN members receive satellite data from DPNs and analyze the data. Usually satellite data before and after a disaster are provided in GeoTIFF or Raw formats. It is important to make value addition by adding other data and information such as GIS layers on populations, buildings, and infrastructures to name a few, so that these value-added products can be readily used by the disaster management agencies and other stakeholders for response purposes. ADRC manages the DAN members and they are spread over 25 member countries of ADRC. If a disaster-affected country has a DAN, then it is always easy for them to coordinate with other agencies within the country to receive relevant data and information to make the value-added products more relevant and useful to the country. One of the DANs is the Geoinformatics Center of the Asian Institute of Technology (AIT) and it has been designated as the Primary Data Analysis Node (P-DAN), which coordinates with other DANs and stakeholders at the time of a disaster to contribute to preparing value-added products. P-DAN, thus has an additional responsibility of managing the data analysis and coordinating with other DANs and stakeholders. P-DAN has also the privilege to receive a copy of all the satellite data acquired through the activation of the Sentinel Asia.

Data Provider Node (DPN) is the space agencies that own satellites to make emergency observations at the time of a disaster and provide the data to Data Analysis Nodes (DAN).

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A panoramic view of the landslide

Example of Sentinel Asia Activations and Products

A landslide occurred on 2 August 2014 in the Sindhupalchowk District of Nepal due to heavy rain. The landslide brought debris and rocks down to the Mankha village and damaged several houses, with 159 casualties. There was an urgency because the landslide blocked the Sunkoshi River forming an artificial dam with the soil and debris came down to the river and this might cause serious flood at the downstream upon collapse of the artificial dam. Several thousands of the population located in the downstream area was evacuated to safe places but 500 tourists were stranded in the upstream of the river due to the road blockage caused by the landslide.

Sentinel Asia was activated by the International Centre for Integrated Mountain Development (ICIMOD), and was later escalated to International Disaster Charter to facilitate the acquisition of as many satellite data as possible by the satellite operators around the world. Due to continuous rains and presence of heavy clouds, optical data acquisition was not possible immediately after the activation, and the first microwave satellite (RADARSAT-2) data of the landslide was received from the Canadian Space Agency, which was acquired on 6 August 2014. Figure 2 shows the value-added product prepared from the Ultra Fine mode of RADARSAT-2 data with a spatial resolution of 3m and it shows that water in the lake created by the artificial dam was extended up to 3km towards its upstream. A cloud free optical data (Pleiades) acquisition was possible on 09 August 2014 by CNES, when sky got cleared from rain and cloud. Figure 3 clearly shows the landslide area and extent of the swelling of water in the artificial dam. Being a member of DAN, ICIMOD coordinated the mission locally in collaboration with the P-DAN, the Geoinformatics Center at AIT. The value-added products were made available to the Ministry of Home Affairs, Nepal and they further disseminated to relevant stakeholders in Nepal and it was also published at the International Charter website.

Landslide in Jure Bazaar, Sindhupalchowk District, Nepal

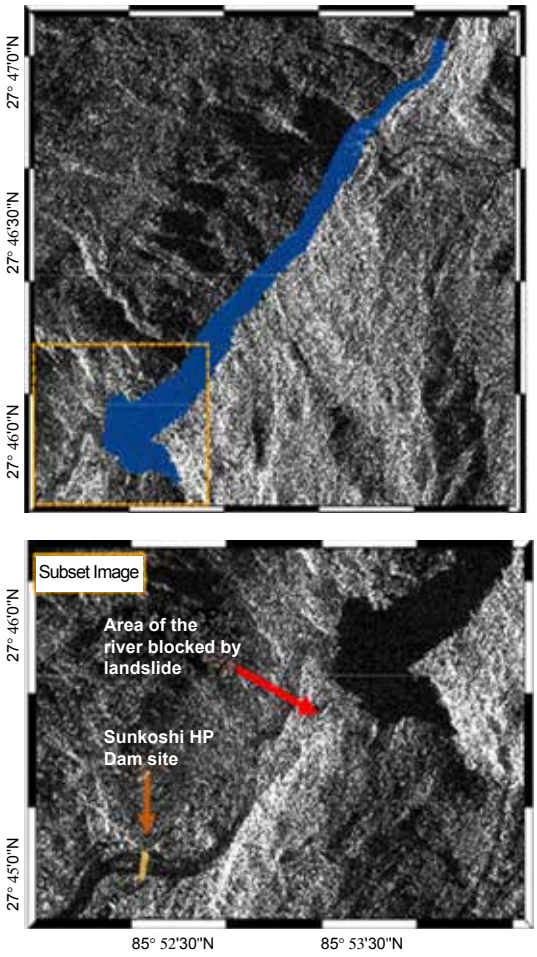
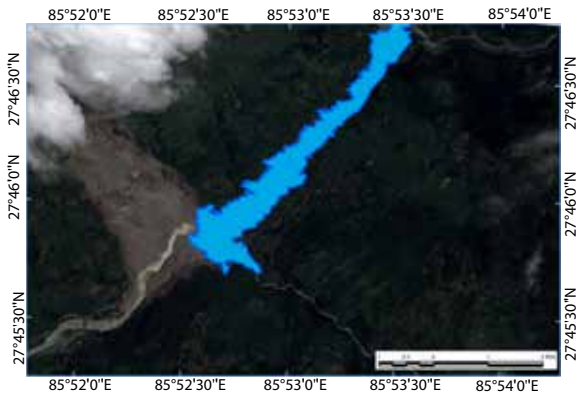


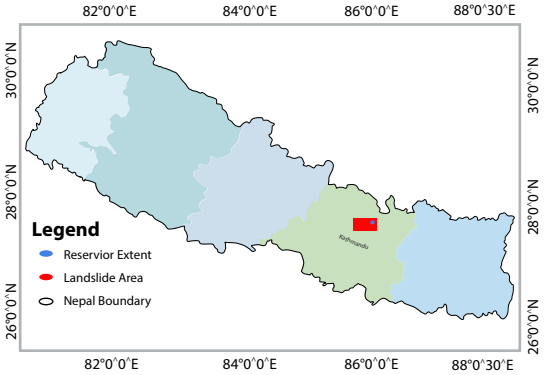
Figure 2: *Products made from RADAR SAT-2 data*

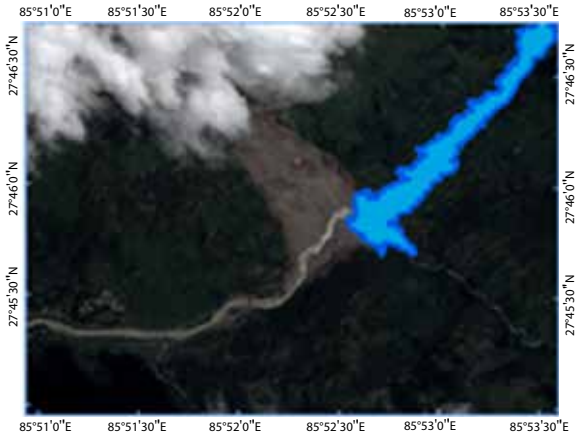
Description:

This map shows landslide affected area and natural reservoir extent formed due to blockage of Sunkoshi River. A disaster image acquired by Radasat-2 on 6 August 2014 was provided by Canadian Space Agency. The natural reservoir is extended up to 3 km upstream flooding the upstream area.

Image: Radasat Ultra Fine
Resolution: 3m
Acquistion Date: 6 August 2014
Copyright: © Canadian Space Agency/ Agence spatiale canadienne (2014)
Coordinate System: Geographic
Datum: WGS 1984



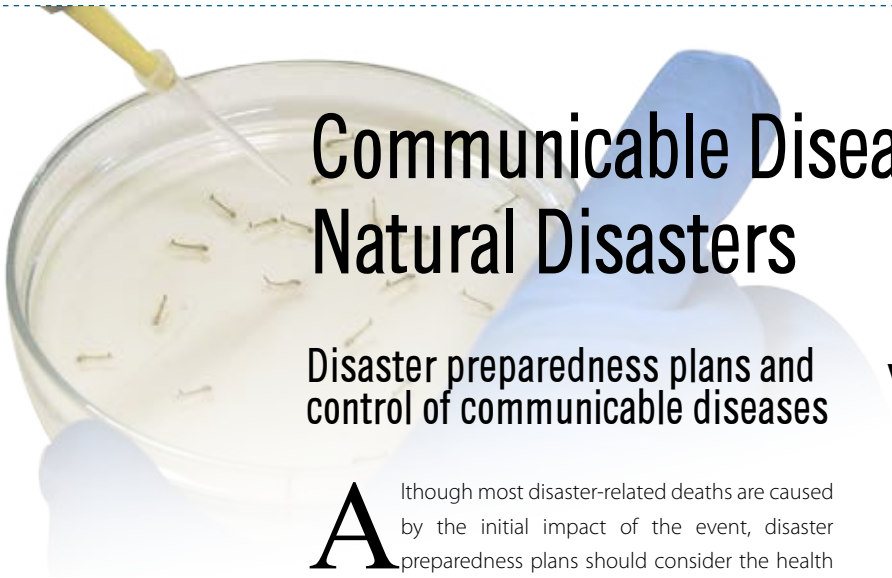




Ten people have been confirmed killed in a landslide in the Sindhupaichowk District of Nepal and over a hundred more are believed lost. The landslide occurred on 2 August 2014 following heavy rain. Landslides are common in Nepal during this time of year, when rain falls on the nation's mountainous terrain. But this landslide brought debris and rocks down on Mankha village, burying dozens of houses and 159 people.

Image: PLEIADES
Resolution: 2.8 m
Acquistion Date: 9 August 2014
Copyright: © CNES 2014
Coordinate System: Geographic
Datum: WGS 1984
Units: Degree

Figure 3: *Products made from Pleiades data*



Communicable Diseases Following Natural Disasters

Disaster preparedness plans and control of communicable diseases

Although most disaster-related deaths are caused by the initial impact of the event, disaster preparedness plans should consider the health needs of the surviving disaster-affected populations. The health impacts are commonly associated with sudden crowding of survivors, often with inadequate access to safe water and sanitation facilities.

The risk of outbreaks following natural disasters, though often incorrectly connected to the presence of dead bodies, is closely related to the size, health status, and living conditions of the displaced population. The risk of transmission of endemic communicable diseases, such as ARI and diarrhoeal diseases, is increased in displaced populations due to associated crowding, inadequate water and sanitation and poor access to health care. Improved detection and response to communicable diseases is important in order to monitor the incidence of diseases, to document their impact and to help to better quantify the risk of outbreaks following natural disasters.

Disaster response teams should be aware of and have access to the latest updated guidelines for communicable disease prevention and control.

Some Communicable Diseases associated with Natural Disasters

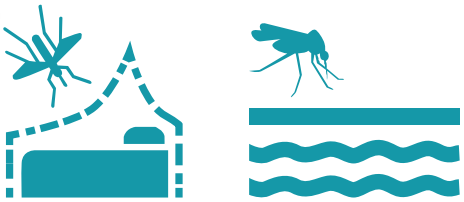
Waterborne diseases

Diarrhea *Hepatitis A and E* *Leptospirosis*

Diseases associated with crowding

Measles *Meningitis* *Acute Respiratory Infections (ARI)*

Vector-borne diseases



Malaria *Dengue*

Prevention of Communicable Diseases following Natural Disasters

- **Safe water, sanitation, site planning**

  Ensuring uninterrupted safe drinking-water is the most important preventive measure to be implemented following a natural disaster. Chlorine is inexpensive, widely available, and effective against nearly all waterborne pathogens.

- **Primary health-care services**

  The immediate impact of communicable diseases can be mitigated through early diagnosis and treatment of a wide range of diseases, and provides an entry point for secondary and tertiary care.

- **Surveillance/early warning system**

  A surveillance/early warning system should be quickly established to detect outbreaks and monitor priority endemic diseases.

- **Immunization**

  Vaccines and supplements should be implemented as soon as possible.

- **Prevention of malaria and dengue**

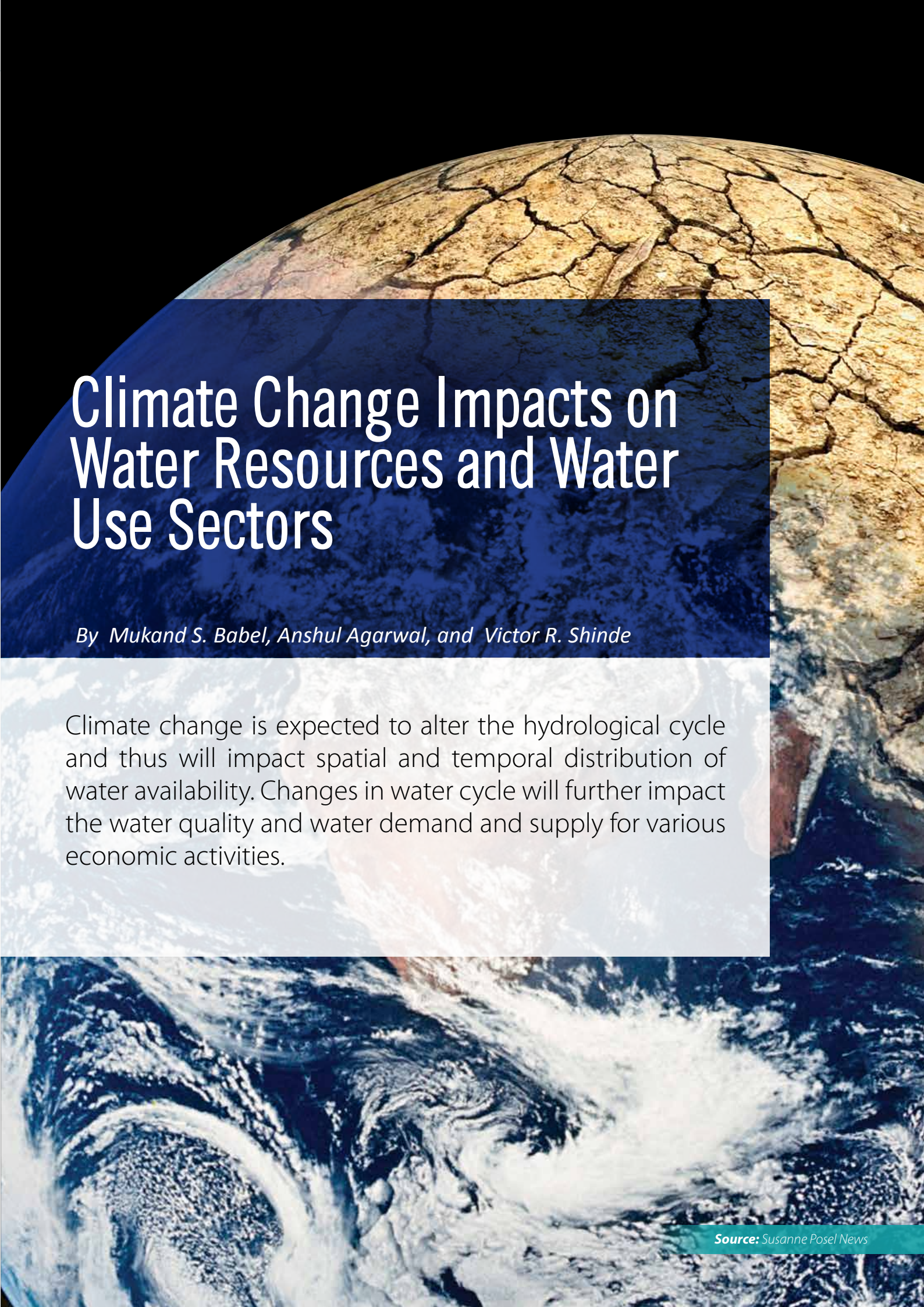
  Specific preventive interventions for malaria must be based on an informed assessment of the local situation, including on the prevalent parasite species and the main vectors. Preventive measures for increased mosquito numbers include indoor residual spraying of insecticides or the re-treatment/distribution of insecticide-treated nets, preferably long-lasting insecticidal nets (LLIN).

For more information, visit:
http://www.who.int/diseasecontrol_emergencies/en/

Climate Change Impacts on Water Resources and Water Use Sectors

By Mukand S. Babel, Anshul Agarwal, and Victor R. Shinde

Climate change is expected to alter the hydrological cycle and thus will impact spatial and temporal distribution of water availability. Changes in water cycle will further impact the water quality and water demand and supply for various economic activities.



Source: *Susanne Posel News*

Climate Change Impacts on Water Resources and Water Use Sectors

Global Projections and Realities

In recent years, there has been increasing scientific evidence that climate change is impacting water resources and related economic sectors worldwide.

Climate change is expected to alter the hydrological cycle and thus will impact spatial and temporal distribution of water availability. Changes in water cycle will further impact the water quality and water demand and supply for various economic activities. It is also expected to exaggerate the frequency of extreme hydrological events.

Global assessments of climate change on hydrology suggest that there has been a discernible and contrasting change in the pattern of runoff (Figure 4): the regions lying in the higher latitudes have been experiencing an increase, while parts of West Africa, southern Europe, and southern Latin America have had a decrease. Climate change is likely to reduce groundwater availability (recharge) in Africa, Latin America, and the Caribbean, whereas there may be an increase in East Asia and the Pacific, Europe, and Central Asia. There has always been a steady increase in the global sea level but because of accelerated glaciers melting in Greenland and the Antarctic the rise has been quite rapid in the last decade, and is projected to rise at a greater rate in the 21st century (Figure 5). A general rise in the mean sea level is expected because of glacier melting, thermal expansion of water, and other related reasons. Climatic change also exacerbates the risk of flooding through extreme precipitation events, higher peak river flows, accelerated glacial melt, increased intensity of the most extreme tropical cyclones, and sea-level rise (Eriksson et al. 2009; Mirza 2010). These changes are already being experienced in many parts of the world today, and are expected to further increase the frequency and magnitude of flood events in the future. In Southeast Asia, the Indian subcontinent, central and eastern Africa, and the upper parts of South America, high flood risk is projected in the 21st century (Figure 6).

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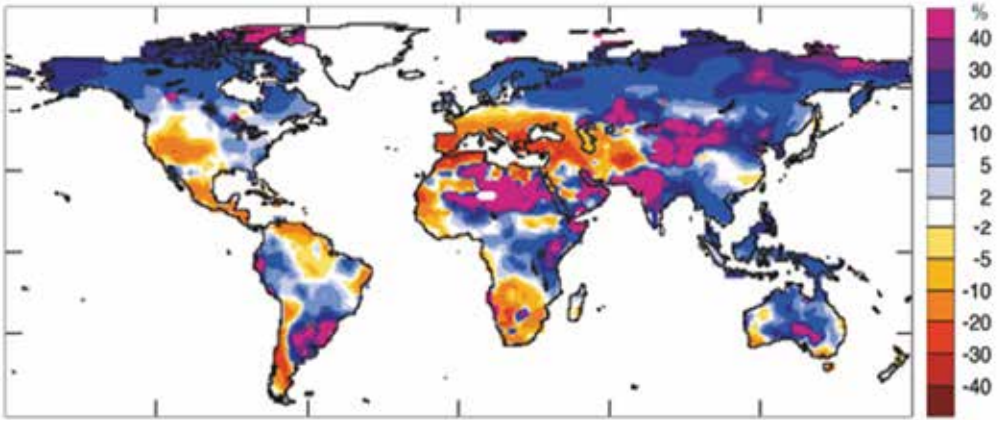
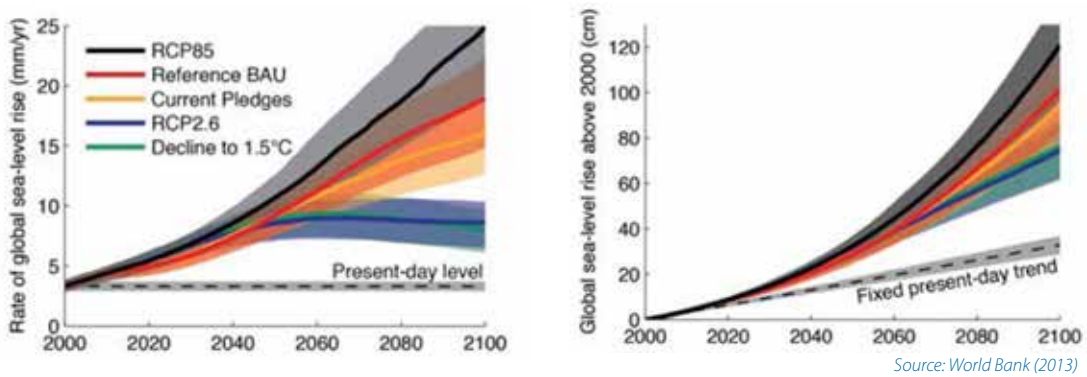


Source: Milly et al. (2005)

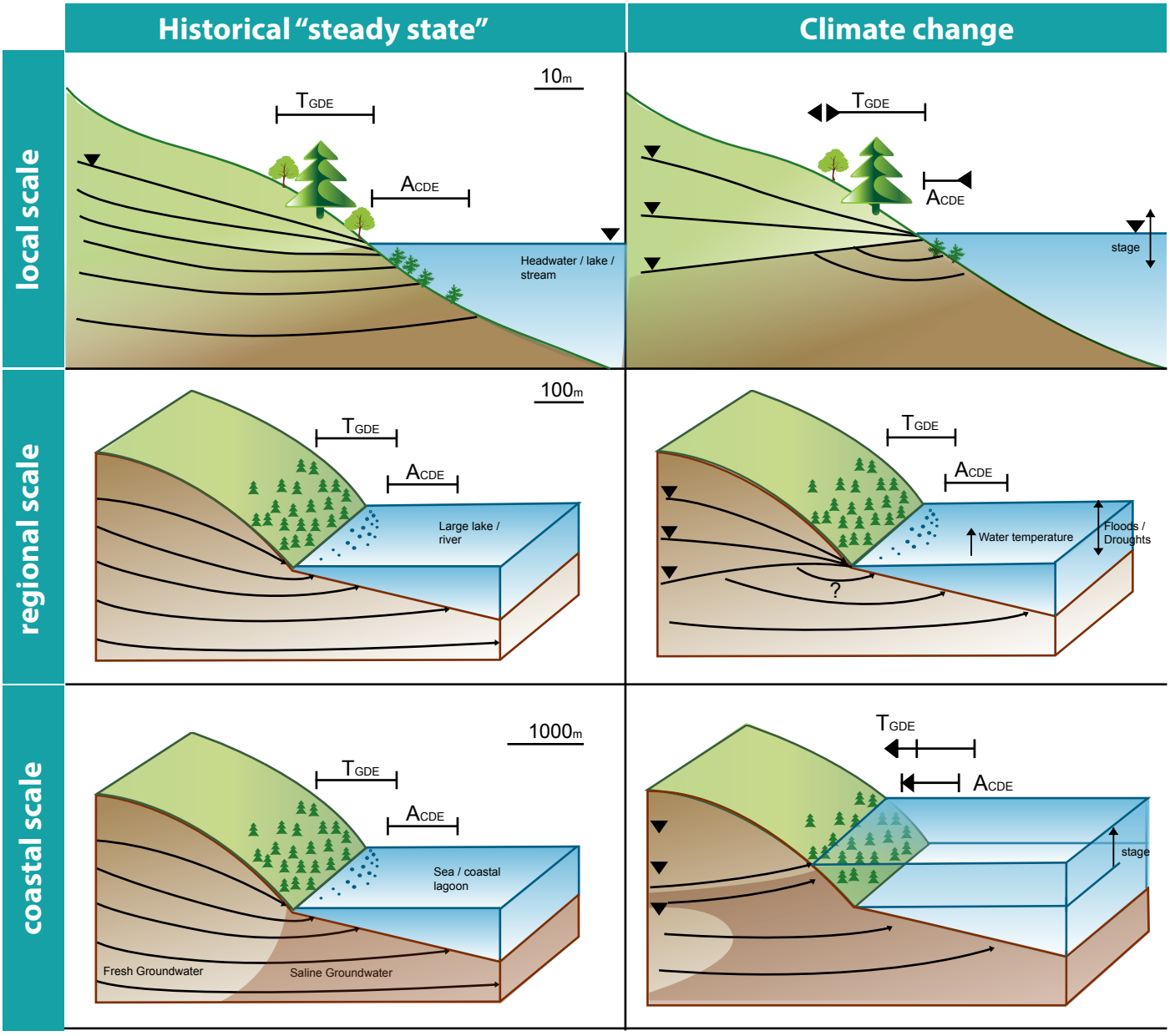
Figure 4 : *Changes in runoff (in percent) for the period 2050s, compared to the 1900–1970 period*



Source: World Bank (2013)

Figure 5: *Rate of global sea level rise and global sea level rise*
Notes 1) Lines show "best-estimate" median projections for each emission scenario, while shaded areas indicate the 66 percent uncertainty range. 2) RCP8.5: A no-climate-policy baseline with high greenhouse gases emissions, referred to at 4°C world by the World Bank. 3) RCP 2.6: A scenario that is representative of the literature on mitigation aiming to limit the increase of global temperature to 2°C.

Impacts of climate change and land use pressures on groundwater levels and flow paths in terrestrial (TGDE) and aquatic (AGDE) groundwater-dependent ecosystems at different scales of water bodies.

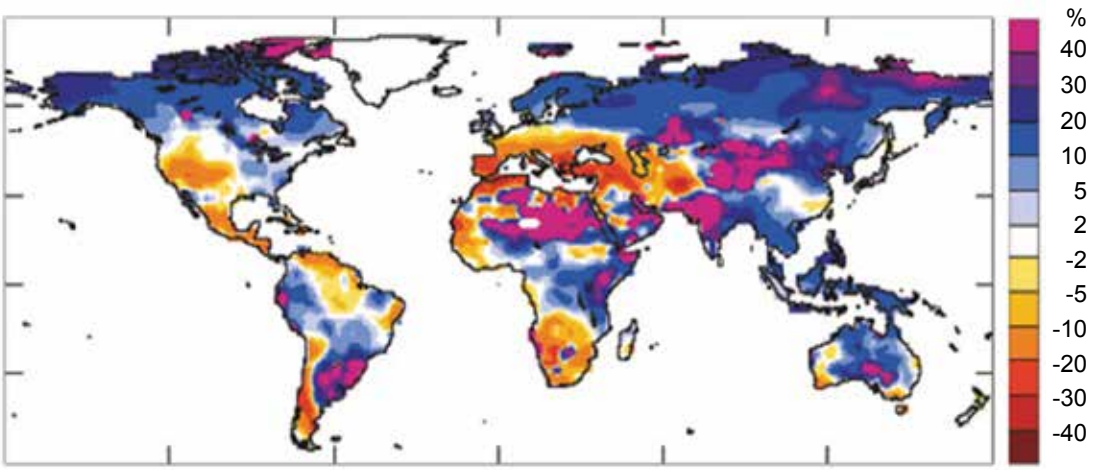


Source: Klove et al. (2013)

Site-Specific Probabilistic Seismic Hazard Assessment

Region	Utilization of groundwater	Climate change impact on recharge
East Asia and the Pacific	Moderate	Increase
Europe and Central Asia	Low	Increase
Latin America and the Caribbean	Moderate	Reduction
Middle East and North Africa	High	Uncertain
South Asia	Moderate	Negligible
Africa	Moderate	Reduction

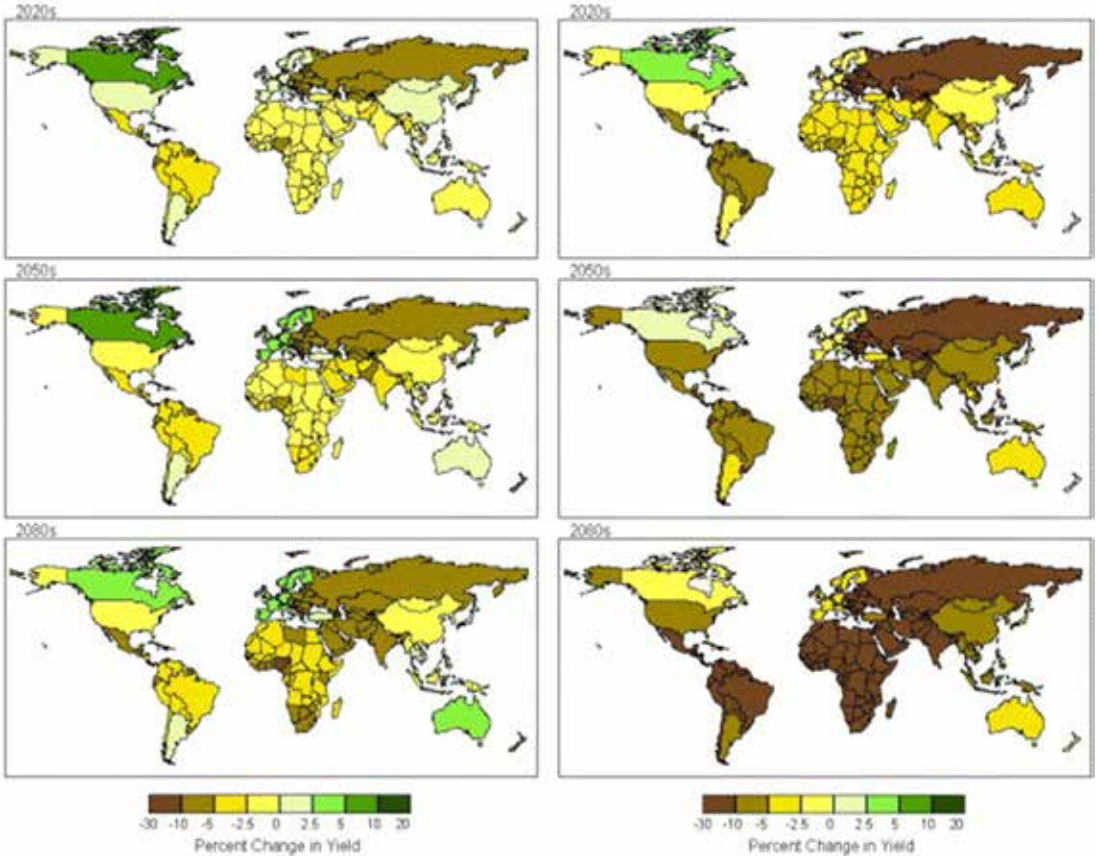
Source: Adapted from Alavian et al. (2009)



Source: Hirabayashi et al. (2013)

Figure 6 : *Projected changes in global flood frequency for the case for the RCP8.5 scenario*

Global warming will lead to higher surface water temperatures which will promote algal blooms and increase microbial content, while more intense rainfall will lead to an increase in suspended solids (turbidity) in lakes and reservoirs due to soil erosion, and contaminant transport (e.g. pesticides, heavy metals, organics etc.). Salinity intrusion in coastal aquifers will become even more pronounced in the face of climate change. Of all the water related sectors, agriculture is likely to be the most affected because of variability in the frequency and magnitude of precipitation patterns, coupled with increased air temperatures. An example of the potential changes in national cereal production is visualized in Figure 7.



Source: Parry et al. (2004)

Figure 7: *Potential changes (%) in national cereal yields for the 2020s, 2050s, and 2080s (compared with 1990) under the HadCM3 SRES B1 scenario with and without CO_2 effects*

Hydropower production is likely to be largely unaffected globally but individual countries and regions may face significant changes as shown in Table 1. It must be noted that while climate change affects the hydrology of a region, there are certain other non-climatic drivers such as land use change, and pollution which influence climate indirectly and have the potential to exacerbate the impacts that climate change is likely to bring about.

Table 1: Regional changes in hydropower generation by 2050 from 2005 conditions

Continent	Region	Generation TWh	Change TWh	% Change of total
Africa	Eastern	10.97	0.11	0.59
	Central	12.45	0.04	0.22
	Northern	15.84	-0.08	-0.48
	Southern	34.32	-0.07	0.83
	Western	16.03	0.00	0.03
		89.60	0.00	0.05
Asia	Central	217.34	2.29	2.58
	Eastern	482.32	0.71	0.08
	South Eastern	57.22	0.63	1.08
	Southern	141.54	0.70	0.41
	Western	70.99	-1.66	-1.43
		996.12	2.66	0.27
Australasia/Oceania		39.80	-0.03	0.00
Europe	Eastern	50.50	-0.60	-1.00
	Northern	227.72	3.32	1.46
	Southern	96.60	-1.79	-1.82
	Western	142.39	-1.73	-1.28
		517.21	-0.80	-0.16
America	Nothern, Central/ Caribean	654.70	0.33	0.05
	Southern	660.81	0.30	0.03
		1315.50	0.63	0.05
Global		2931	2.46	0.08

Source: Hamududu et al. (2012)

Note: *Russia and Turkey have been included in Asia.*

Case Studies: Evaluating Climate Change Impacts

1. Water Resources: Case of the Bagmati River Basin, Nepal

Total catchment area: 3,750 km^2
Project catchment area: 2,789 km^2
Mean annual temperature of 20–30°C
Average annual precipitation 1,800 mm

This study quantified the changes in future climate and its impact on the hydrology of the Bagmati River Basin in Nepal.

The Bagmati River Basin (BRB) is one of the major basins of Nepal and sustains much of the socioeconomic activities of the country. BRB is divided into three parts as upper (Kathmandu valley), middle (mountains/hills), and lower (Terai) considering the physiographic variation. This study, however, considered the upper (Kathmandu valley) and middle (mountains/hills) parts of the Bagmati Basin up to the Pandheradobhan gauging station, as shown in Figure 8.

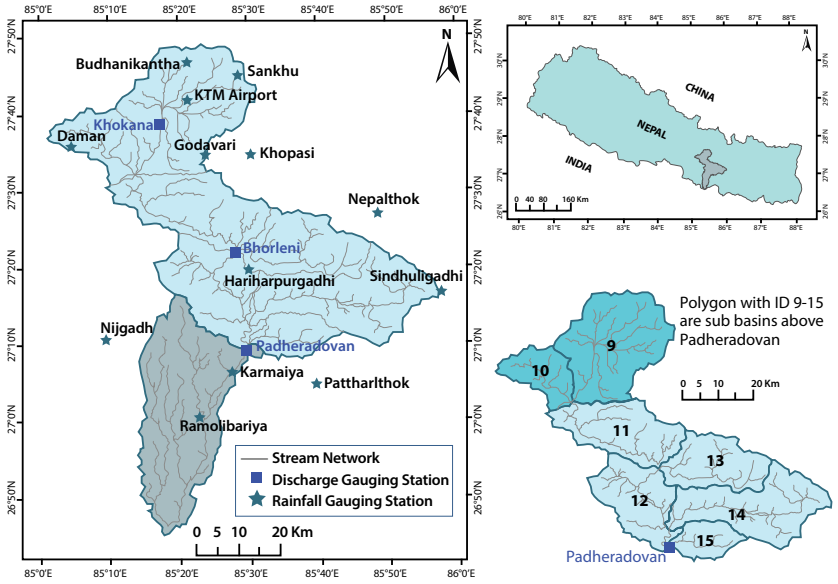


Figure 8: *Bagmati River Basin (BRB)*

Source: : Babel et al. (2013)

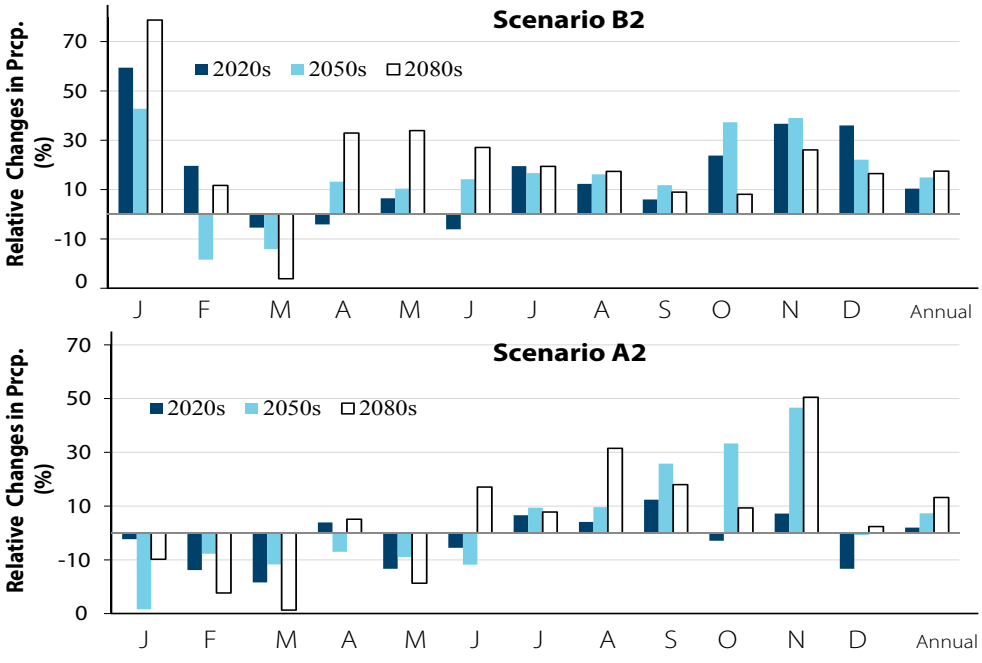
The basin's water is widely used for drinking, irrigation, industrial, and other purposes in the Kathmandu Valley. With increasing population density, unplanned rapid urbanization, land conversion to agriculture, and unregulated and illegal quarries have been responsible for degradation of the river water's quality and quantity (Babel et al. 2013). The uncertainty of future water availability on a basin scale has seriously impaired water resource planning in the BRB, thereby increasing the risk of failure of water-related programs and projects. To address the issue, this case study analyzed future changes in local climate and their impact on the hydrology of the BRB to help in managing water more efficiently and making necessary plans of adaptation in changing climatic conditions.

The Hadley Centre Coupled Model, version 3 (HadCM3) GCM data was used to capture future climate projections for BRB. The resolution of the HadCM3 is very coarse for hydrological analysis at the basin level. Therefore, a statistical downscaling model (SDSM) was employed to downscale GCM data at the station level. Downscaling results indicate that the SDSM model was able to estimate both mean and extreme values of temperature and mean values of precipitation with considerable reliability. Four scenario runs, each of 30-year periods, were developed for SRES scenarios A2 and B2. The changes relative to the baseline period (1970-1999) were calculated for three future periods 2020s, 2050s, and 2080s. To analyze the climate change impact on streamflow, monthly, seasonal, and annual variations on water availability were computed for each of the future time periods. To assess spatial variations of climate change impact within the basin, the changes in future water availability were estimated for the upper and middle parts of the basin.

Results show a higher rise in temperature during summer as compared to winter (Table 2). Future average annual basin precipitation is predicted to increase under both A2 and B2 scenarios. However, dry season is expected to become drier while the wet season is expected to become wetter under A2 Scenario (Figure 9).

Table 2: Basin average change in seasonal Tmax for three future time periods relative to the baseline period (1980s)

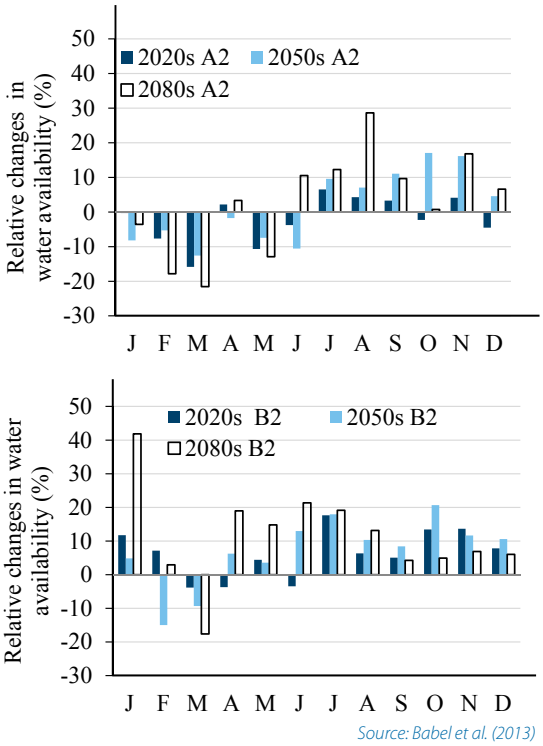
	Winter		Spring		Summer		Autumn		Annual	
Scenario	A2	B2	A2	B2	A2	B2	A2	B2	A2	B2
Period										
2020s	0.4	0.4	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2050s	1.0	0.9	1.2	0.9	1.2	1.1	1.0	0.8	1.1	0.9
2080s	1.8	1.4	2.4	1.6	2.1	1.7	1.9	1.3	2.1	1.5



Source: Babel et al. (2013)

Figure 9: *Changes in basin average monthly precipitation for three future periods relative to the baseline period (1980s). (a) Scenario A2 and (b) Scenario B2*

It is anticipated that the annual water availability during all three future periods may increase under both A2 and B2 scenarios, indicating that the basin as a whole become wetter when water accounting is done annually. There may be a wide variation in seasonal and monthly water availability (Figure 10).



Source: Babel et al. (2013)

Figure 10: *Percentage changes in monthly water availability during three future periods relative to the baseline period (1980s) for the whole Bagmati river basin (a) Under Scenario A2 and (b) Under Scenario B2*

Under A2 scenario, the pre-monsoon water availability may decrease, indicating a worsening situation of water stress during the dry season. However, an increase in the post-monsoon water availability may relieve the water stress situation to some extent. In contrast, under B2 scenario, water availability is expected to increase during both wet and dry seasons. Higher water availability during the wet season under both A2 and B2 scenarios may worsen the flood situation in the future.

2. Water Use Sector: Case of Rice Cultivation in Northeast Thailand

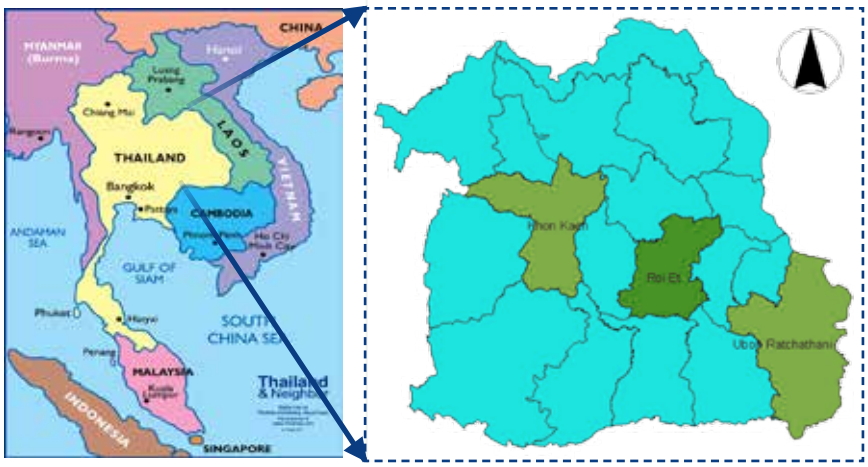
Average temperature: 19.6 - 30.2°C
Average annual rainfall: 1,270 - 2,000 mm
Average rice yield: 1.9 t ha^{-1} (lowest in the country), countrywide average = 2.5 t ha^{-1}

The objective of the study was to assess the impacts of future climate change on rice yield in Northeast Thailand using the CERES-rice model (DSSAT Version 4.0).

Rice production in the region relies mainly on rainfall; irrigation is limited to about 20% of the total rice producing area. The region has a tropical climate, with October–February is the cool season, while March–May is the hot season, with highest temperatures observed in the month of April. Rainfall in the region is highly unpredictable, mainly concentrated in the rainy season, May–October. Soils of the study area are highly acidic, saline, and low in fertility. The present study used the climatic and soil data, as well as other information, from crop experiments conducted at the Rice Research Centers (RRC) in three provinces, namely Khon Kaen, Roi Et, and Ubon Ratchathani, representing Northeast Thailand (Figure 11).

Rainfed rice is grown under poor conditions, such as poor crop management with low inputs, and is highly subjected to climatic variability. The major production constraints are high rainfall variability, drought, submergence, and inherent low soil fertility. The main varieties of Jasmine rice, namely KDML105 (Khao Dok Mali 105) and RD6 (Rice Department 6), are medium-maturing varieties and cover almost 80% of the rice fields in Northeast Thailand.

The study investigated the effects of climate change on rice production in Northeast Thailand using CERES-Rice crop growth model. The future climate data was collected from the Southeast Asia START Regional Center at Chulalongkorn University, Thailand and were predicted using the global climate model (GCM) ECHAM4 (ECMWF atmospheric general circulation model coupled with the University of Hamburg's ocean circulation model) developed for the global resolution of 280 X 280 km by the Max



Source: Babel et al. (2011)

Figure 11: *Northeast Thailand and three study provinces*

Planck Institute, Germany. These data were computed and analyzed considering world growth forced by a level of atmospheric CO_2 according to the IPCC SRES A2 scenario, one of the most pessimistic projections. These data were further downscaled at the regional level using the regional climate model (RCM) PRECIS, providing regional climates for impact studies, for the study area at 25 X 25 km resolution. The downscaled data for the periods of 2020–2029, 2050–2059, and 2080–2089 for the grid that falls nearest to the study locations in the three provinces were used.

The impacts were then determined by computing the changes in the yield averaged for each of the three future decades (2020–2029, 2050–2059, and 2080–2089), with respect to the yield as obtained for the actual daily weather data collected for 10 consecutive years from 1997 to 2006 for the study sites.

The results showed that the CO_2 concentration, temperature, and rainfall are found to increase in future in the study area. The combined effect of these changes may adversely affect the future rice yield (Table 3). The vulnerability of rainfed rice production to climate variability and changes may lead to further large yearly fluctuations in the yield in the study area.

Table 3: Simulated rice yield and changes (%) for three future periods

Location	1997-2006 Yield (kg/ha)	2020-29		2050-59		2080-89	
		Yield (kg/ha)	Change (%)	Yield (kg/ha)	Change (%)	Yield (kg/ha)	Change (%)
Ubon	2732	2427	-11.16	2200	-19.47	1855	-32.10
Khon Kaen	2807	2101	-25.15	1883	-32.91	1901	-32.27
RoiEt	2128	1764	-17.11	1481	-32.11	1944	-8.64
Average	2556	2097	-17.81	1855	-27.59	1900	-24.34

Source: Babel et al. (2011)

This article is part of a full chapter of the book Climate Change and Water Resources published by CRC Press, Taylor and Francis Group. For more information, visit:

http://www.amazon.com/Climate-Change-Resources-Sangam-Shrestha/dp/1466594667

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AIT's Disaster Preparedness, Mitigation and Management (DPMM) Post-graduate Program

Rapid escalation and intensity in the incidence of severe disaster events have become a huge threat to the global community. Due to fast rate of population growth, urbanization, poverty, climate change, and geographical location, most of the Asian countries have become highly susceptible to natural disasters such as flood, cyclone, drought, earthquake, landslide, extreme temperature, heavy rain, epidemics, etc. It has been felt that there is limited capacity at global, regional and national levels in terms of knowledge base, skills training, long-term planning, emergency preparedness, and policy development to respond to such severe disaster events.

As a focal point for education in Asia, AIT is in a unique position to help individuals, neighborhoods, businesses, and local governments to prepare for and respond to disasters.

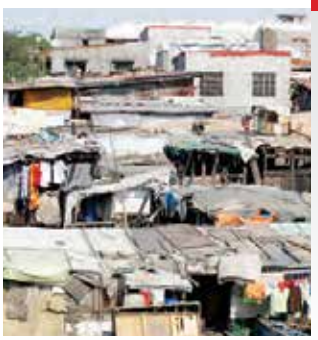
One way is through the Disaster Preparedness, Mitigation and Management (DPMM) program. This program aims to instill the necessary interdisciplinary capacities to manage and minimize the effects of disasters in people on the front lines of disaster response and preparedness. Courses are designed to accommodate applicants with engineering, architecture, natural and social sciences, as well as management backgrounds.

DPMM works closely with its partners/collaborators to enhance a wider understanding and knowledge sharing from the international level to local level. Program graduates will be ready to play leading roles in developing appropriate disaster management policies, strategies, and techniques as well as in raising awareness in communities to protect people from the increasing disasters and helping build resilient communities.

ACADEMIC PROGRAM & COST OF STUDY

DEGREE	Post-Graduate Certificate Program	Professional Master Degree Program	Master Degree (Regular Program)	Doctoral Program
Entry requirement	Bachelor degree	Bachelor degree plus 3 years work experience	Bachelor degree	Master degree
Credit requirement	12 credits (4 courses of 3 credits each)	33 credits plus an internship in summer	50 credits (28 credits course work and 22 credits master's thesis study)	84 credits
Duration (Semesters)	15 weeks (1 semester)	12 months academic program (spanning 2 semesters and a summer period of 12 weeks)	22 months academic program (4 semesters)	36 months (6 semesters)
Cost of Study	188,000 Baht	502,000 Baht	752,000 Baht	1,296,000 Baht

***DPMM** is an interdisciplinary academic program at AIT that aims to produce high quality of professionals for better contribution in disaster preparedness, mitigation, and management.*



For more information, visit: *http://dpmm.ait.ac.th/*

PARTNERS & COLLABORATORS

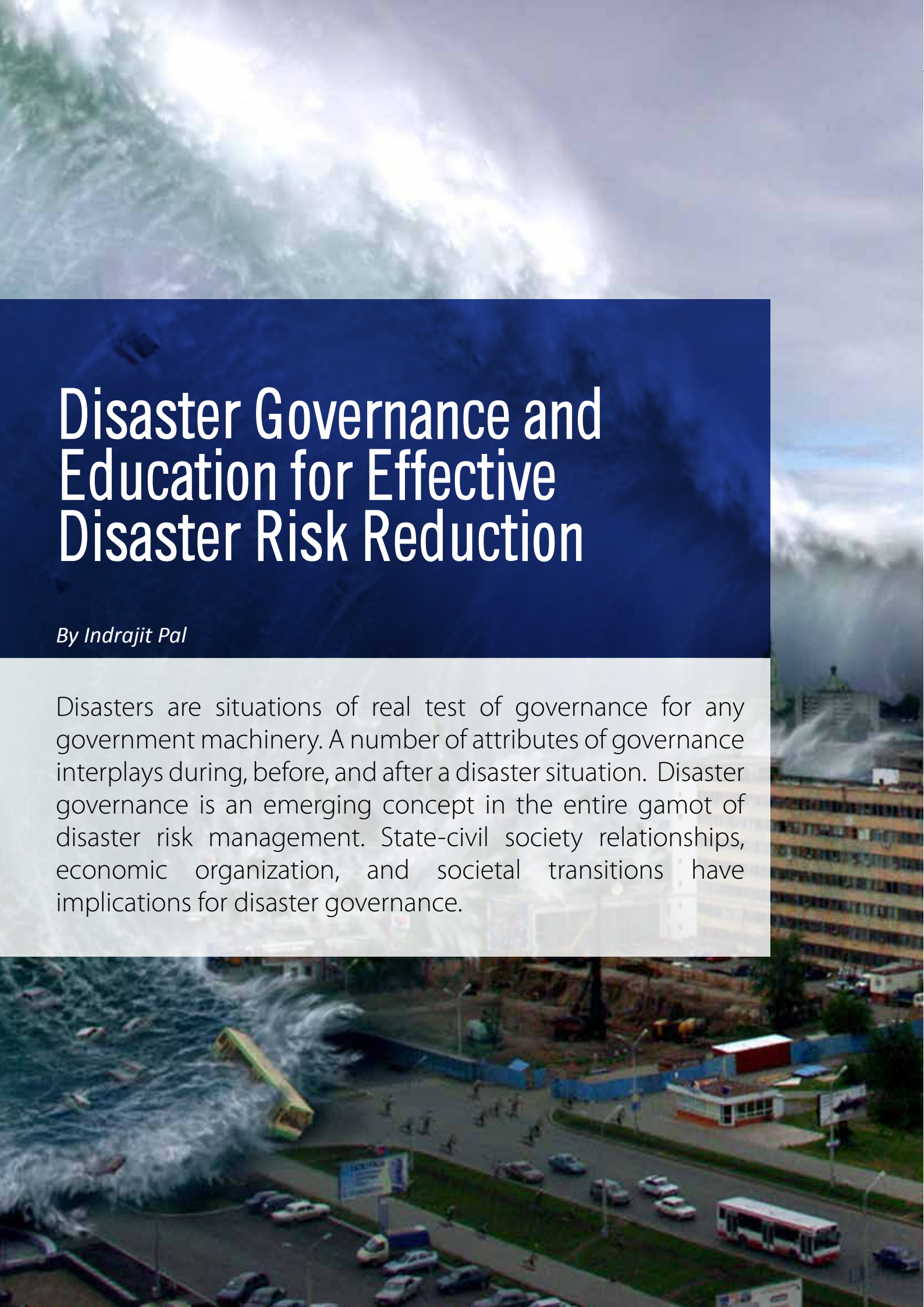
OCHA VNU UNIVERSITY OF MALAYA

International Federation of Red Cross and Red Crescent Societies IRDR

ADMISSION REQUIREMENT

Applications for admission are accepted regularly throughout the year. To ensure sufficient time for visa processing and other formalities, applications must reach AIT by:

January Intake	15 October (for scholarship applicants)
	15 November (for self-financed applicants
August Intake	15 March (for scholarship applicants)
	15 June (for self-financed applicants)



Disaster Governance and Education for Effective Disaster Risk Reduction

By Indrajit Pal

Disasters are situations of real test of governance for any government machinery. A number of attributes of governance interplays during, before, and after a disaster situation. Disaster governance is an emerging concept in the entire gamot of disaster risk management. State-civil society relationships, economic organization, and societal transitions have implications for disaster governance.

Disaster Governance and Education for Effective Disaster Risk Reduction

Disasters are situations of real test of governance for any government machinery. A number of attributes of governance interplays during, before, and after a disaster situation. Disaster governance is an emerging concept in the entire gamot of disaster risk managemt. State-civil society relationships, economic organization, and societal transitions have implications for disaster governance. Various research on linkages between disaster governance and need for disaster education suggests that capacity building or trained manpower with the knowledge of disaster risk management (DRM) is one of the important factors that contribute to effective governance and its long-term sustainability.

In order to improve effective disaster management, one must first understand the components of a disaster and how they interact with knowledge systems, both expert and local. Disasters take place out of the interaction between a natural hazard and human vulnerability (Figure 12). In other words, natural disasters cannot arise simply out of natural forces, but must interact with social organizations to result in disaster. The natural, physical, and social sciences provide valuable knowledge regarding hazards and vulnerability, but disasters have a social component comprised of norms, values and perceptions (Rodriguez, Diaz, & Aguiree 2004).

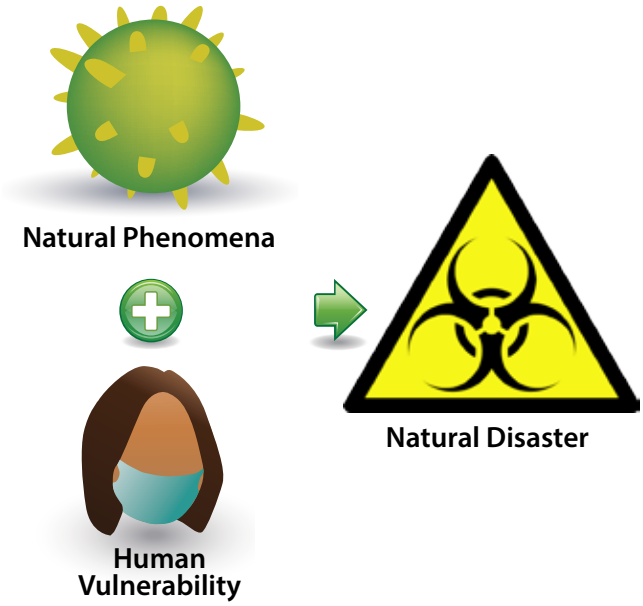


Figure 12: *Interaction between Natural Phenomena and Human Vulnerability*

In the two decades since the 1990s, the number of natural disasters has doubled from around 200 to more than 400 a year. According to the United Nation's International Strategy for Disaster Reduction (ISDR), more than 2.2 million people around the world have been killed in natural disasters since 1975. Two thirds of the victims and damages were the result of storms, floods, droughts, and other meteorological phenomena.

"Anticipating, Educating and Informing are the keys to reducing the deadly effect of such natural disasters. Unfortunately such activities have not been given priority"

Koïchiro Matsuura

UNESCO Director-General, 2005

The Yokohama Strategy for a Safer World in 1994 provided landmark guidance on reducing disaster risk and the impacts of disasters. Knowledge management and education, apart from disaster governance, risk identification, preparedness, to name a few, are identified as one of major gaps and challenges for DRM. The Hyogo Framework for Action 2005-2015 also emphasized the importance of capacity building and Disaster Risk Reduction (DRR) for effective governance and resource management. One of the important components in DRR is the creation of skilled and trained professional manpower.

Institutionalization of DRR in the disaster governance through a sensitized cadre of officers and personnel, needs more attention in education. Manpower trained in formal disaster educations are the first requirement for mitigation, monitoring, and management of disasters. Personnel with the formal knowledge of disaster risk management helps in quick rehabilitation of people affected in disasters, and understands their psychological conditions and helps in their post disaster settlement. In the planning and policy-making, trained and experienced personnel are highly required to give better suggestions and optimization of resources.

The demand for disaster managers is growing in parallel to the number of natural disasters and crises.

Disaster preparedness and disaster management or crisis management belong together and require quite different skills. When enrolled in a program, and in different study courses, students learn how to cope with the after-effects of humanitarian crises and natural disasters as disaster managers. They learn how to draw up emergency plans, coordinate assignments and set up a crisis team. Programs in disaster mitigation and recovery cannot be successful without building adequate trained and skilled manpower.

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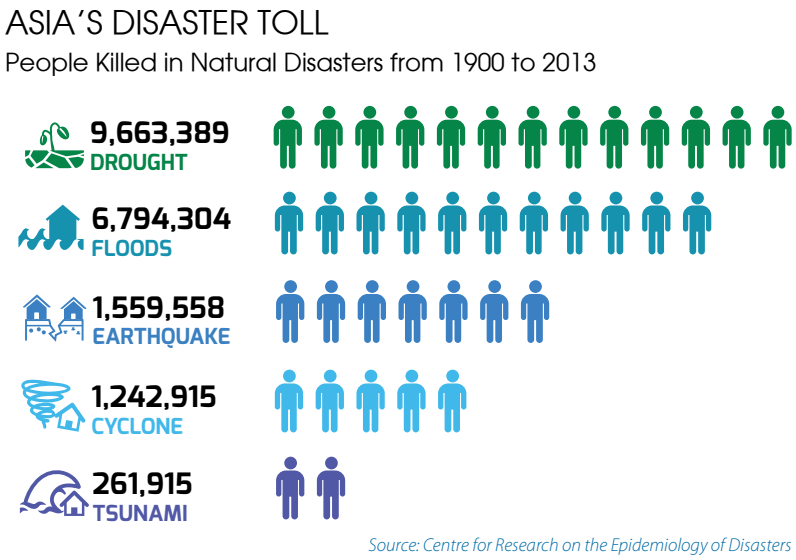

Figure13: *Death toll due to Natural Disasters in Asian countries from 1900–2013*

Focused capacity building has given rise to a new vision on disaster management, but the efforts towards building capacities have not been very systematic. The need for building capacities of the grassroots level stakeholders in disaster management another challenge for effective disaster governance. For instance, earthquakes, storms, floods, and droughts pose a threat to the population throughout the world – and they are increasing in numbers. So there is an urgent need for people who know what to do in an emergency. Disaster management studies prepare students for this work. Disaster management combines various courses of study aiming to raise awareness about the challenges the job holds, create global networks and formulate international standards for disaster management.

Asian countries are very much prone to natural disasters because of the geoclimatic conditions and the impacts of the disasters get exaggerated with the socio-economic vulnerability and population density (Figure 13). More than 85% of all the people affected by disaster in the world are residing in Asia-Pacific region and it becomes the center stage of all disasters (Figures 14 and 15). Due to rapid rate of population growth, urbanization, poverty, climate change, and geographical location; most of the Asian countries have become highly susceptible to flood, cyclone, drought, earthquake, landslide, extreme temperature, heavy rain, and epidemics. It has been felt that there is limited capacity at global, regional, and national levels in terms of knowledge base, skills training, long-term planning, emergency preparedness, and policy development to respond to such severe disaster events. Therefore, a

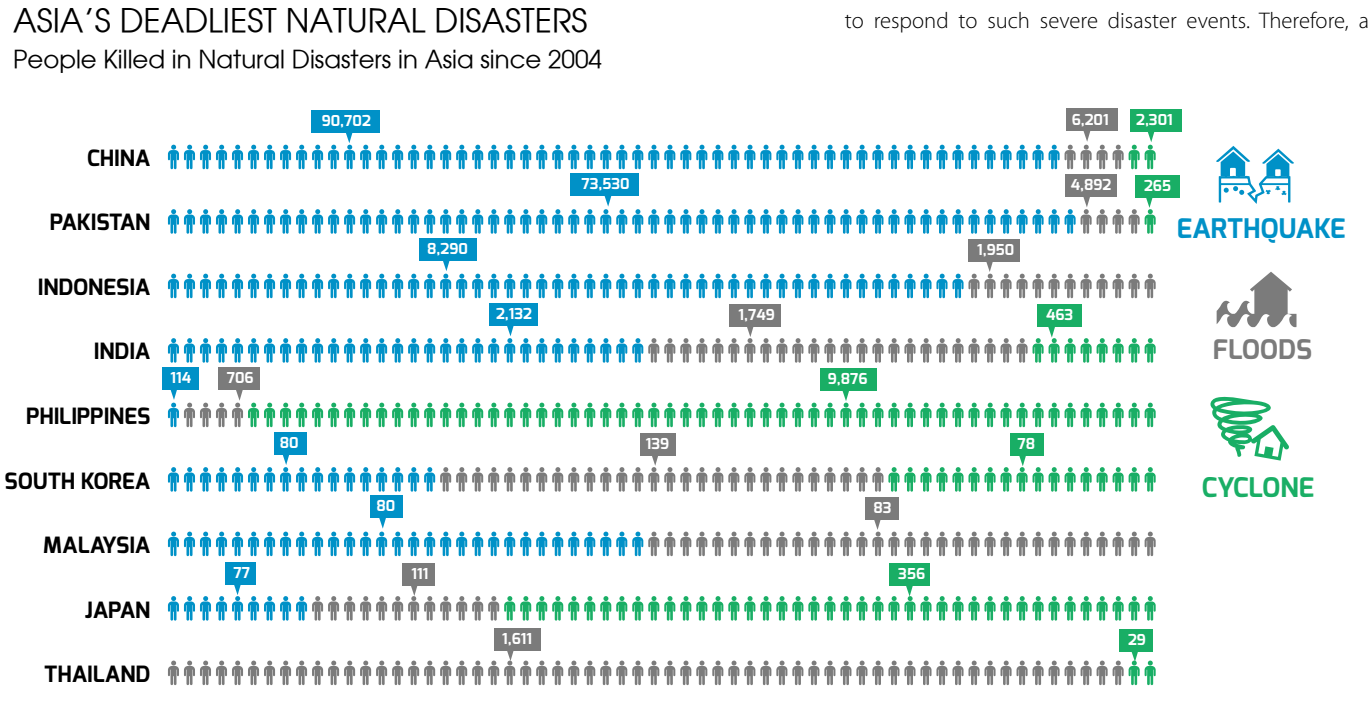

Figure 14: *Deadliest Natural Disasters in Asia*

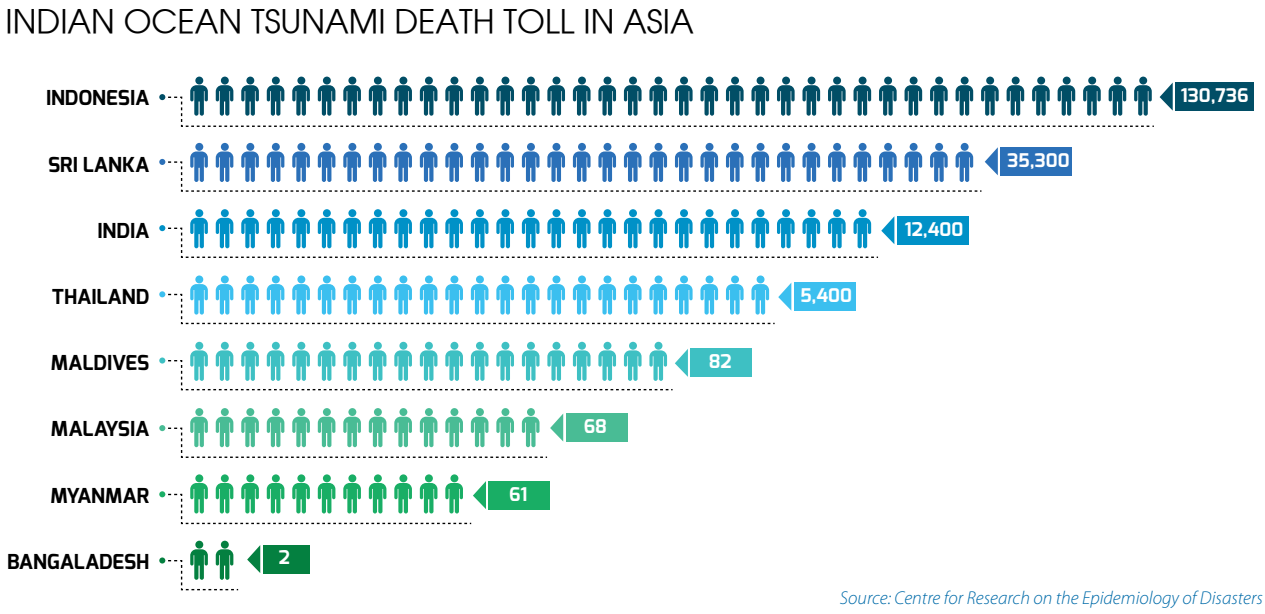

Figure 15: *Death tolls in Asian Countries due to Indian Ocean Tsunami*

significant demand and necessity of trained manpower that can assist at the time of disaster as well as in planning of schemes, monitoring, and management of disasters is inevitable. In the present context of a changing technological scenario, there is also urgent need of trained manpower for the industry as well as government and/or private organizations.

In order to address the issues in innovative ways, the Disaster Preparedness, Mitigation and Management (DPMM) program was introduced by Asian Institute of Technology (AIT), Thailand in 2008. AIT uses an interdisciplinary approach to manage and minimize the effects of disasters in people on the front lines of disaster response and preparedness. It provides professional education and short-term training for the capacity building of the Asia-Pacific as well as neighboring regions apart from advocacy, research, and consultancy on Disaster Risk Management and Climate Change Adaptation domain. The education prorammes at AIT has been running successfully with students from various countries frequently affected by natural disasters such as Bangladesh, Canada, China, India, Indonesia, Iran, Maldives, Myanmar, Pakistan, Philippines, Singapore, South Africa, Sudan, Thailand, Tibet, and Vietnam.

Courses offered by AIT on Disaster Risk Management range from master's degree, professional master's degree, doctoral program, post-graduate certificates, and certificates, diploma programs, customized short-term programs, and seminar series. Students are also diverse ranging from bureaucrats to regular masters student coming from all over the world. The course addresses all stages of disaster management in a comprehensive and holistic manner; including (i) pre-disaster preparedness and mitigation, (ii) rescue and relief in the context of disaster, and (iii) post-disaster rehabilitation, reconstruction, and recovery.

The Asian Institute of Technology, being an international organization and one of the Asia's leading higher learning institutes, promotes and advocates DRM and governance through research, outreach, capacity development and strengthening of disaster education for effective DRR.

Disaster management graduates have a wide variety of job prospects: in government or non-governmental organisations, in the private sector, for banks, companies, churches, research institutes and governments. Most project-related work offers two options: people either work directly in the field, or they coordinate assistance from an office.

Education for DRR takes into account the relationships between society, environment, economy, and culture and their impacts. It also promotes critical thinking and problem-solving as well as social and emotional life skills that are essential to the empowerment of groups threatened or affected by disasters.

Educational institutions through its interdisciplinary and holistic approach to learning, helps create resilient societies. It encourages a long-term perspective in decision-making processes, critical thinking, and holistic and innovative approaches to problem-solving. The Institute, therefore, contributes to DRR while DRR increases the relevance and the quality of education in disaster-prone areas.

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25 of the World's Worst NATURAL DISASTERS

Haiti Earthquake (2010)

A magnitude 7.0 earthquake with a depth of 8.1 miles rocked Haiti on January 12, 2010. This is the strongest earthquake to hit the country since 1770, it led to over 200,000 deaths, 2 M homeless, and 3 M people in need of emergency aid.

Cyclone Nargis (2008)

The first cyclone in 2008 to hit the northern Indian Ocean, Cyclone Nargis made landfall in Myanmar and devastated the Ayeyarwady Delta region along with its 37 townships for two days. 84,500 people were killed with 53,800 missing.

Pakistan Earthquake (2005)

The 2005 Pakistan earthquake, 7.6 magnitude, had its epicenter in Kashmir near the city of Muzaffarabad. Occurring on the morning of October 8, 2005, the official death toll was 75,000 people with 106,000 people injured.

Hurricane Katrina (2005)

The deadliest hurricane to hit the Gulf Coast in 2005, Hurricane Katrina was ranked as the sixth strongest to ever hit the United States. It was also one of the costliest with estimated property damages of US $81 billion.

Indian Ocean Earthquake (2004)

With a magnitude of 9.15, the Indian-Ocean earthquake lasted for only 10 seconds and caused a tsunami that killed up to 310,000 people along the shores of Indonesia, Sri Lanka, South India, and Thailand with one death occurring in South Africa, 8,000 miles away from the epicenter.

Nevado del Ruiz Volcano Eruption (1985)

Also famed as La Mesa de Herveo, this stratovolcano caused the second largest volcano-related disaster of the 20th century. The volcano produced an enormous flow that buried and devastated the town of Armero in Tolima in November 13, 1985 and caused the death of 25,000 people.

Tangshan Earthquake (1976)

The Great Tangshan earthquake struck China on July 28, 1976 causing the death of 240,000 people and injured 164,000 more. Regarded as the deadliest earthquake of the 20th century, the 7.8 magnitude earthquake hit an area causing the city of Tangshan to be obliterated.

Hurricane Andrew (1993)

This hurricane was formed by a tropical wave that moved to the west coast of Africa on August 14, 1992. Due to the massive destruction that caused 65 fatalities and US $26 billion in property damages, this became the 5th costliest hurricane in US history.

Tohōku Earthquake and Tsunami (2011)

A 9.0 magnitude earthquake followed by tsunami waves hit Japan in March 11, 2011. With a depth of 24.4 km, this led to 15 M dead or injured, affected 18 prefectures, destroyed over 250,000 buildings, and caused partial meltdown in 3 reactors of the Fukushima nuclear plant.

Aleppo Earthquake (1138)

The deadliest earthquake in history occurred in October 11, 1138 and was named after the city of Aleppo in Syria, now called Halab. Its death toll was approximated at 230,000 and the city was destroyed along with its surrounding areas.

Haiyuan Earthquake (1920)

Also known as the 1920 Gansu Earthquake, this is the 4th worst earthquake ever recorded next to the Antioch Earthquake in the year 526. With a death toll of 240,000, its epicenter in Haiyuan County, in the Ningxia Province of China.

Antioch Earthquake (526)

The third worst earthquake disaster in the world happened in the year 526 and may have probably struck late in May as there is no specific date on record. This major earthquake hit Syria and Antioch with a death toll between 250,000 to 300,000.

Bhola Cyclone (1970)

Reaching wind speeds of 185 km/h, the Bhola Cyclone in Bangladesh led to over US $490 million in damages, destroying 85% of the homes in the region. It also fetched storm surges that wiped out entire villages, killing 45% of the population in Tazumuddin. Nearly 500,000 perished.

New Zealand Earthquake (2011)

Also known as the Christchurch earthquake, this magnitude 6.3 quake that occurred on February 22, 2011 was one of the nation's deadliest peacetime disasters. This caused significant damage to the central Canterbury region with an estimated US $16 billion worth of damages.

Afghanistan Blizzard (2008)

This blizzard had an estimated death toll of 1,337 due to temperatures below -30°C with up to 180 cm of snow. Some were frozen to death, many died when their vehicles were blocked by snowdrifts, and at least 100 people underwent frostbite amputations. It claimed over 415,000 livestock.

East Africa Drought (2011)

Due to the worst drought in 60 years, the Horn of Africa experienced widespread death and famine inmid-July of 2011. An estimated 12.4 million people were affected and resulted in a crisis across Kenya, Somalia, Ethiopia, and Djibouti.

North Korean Famine (1994)

Recognized as the "Arduous March", this famine that devastated North Korea from 1994 to 1998 had an estimated death toll of between 240,000 and 3,500,000 caused by starvation and hunger-related illnesses

European Heat Wave (2003)

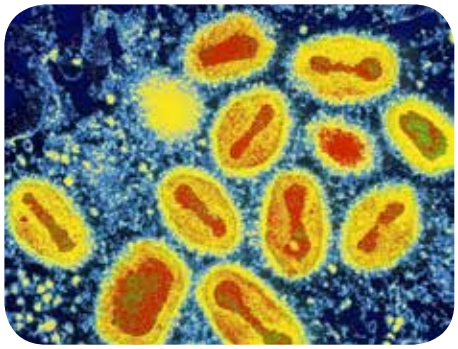
When the 2003 European heat wave struck (the hottest since 1540), it resulted in a health crisis in several countries and a drought which led to crop shortage, especially in Ukraine where 75% of wheat crops were lost.

Yangtze River Floods (1931)

When torrential rains hit southern China in August 1931, it caused the Yangtze River to flood killing nearly 3.7 million people. This was considered the worst natural disaster of the 20th century.

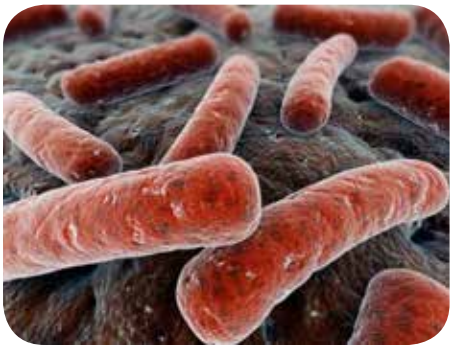
Mozambique Flood (1931)

Occurring between the months of February and March in 2000 the catastrophic flooding was caused by torrential rainfall that lasted for 5 weeks.



North American Smallpox Epidemic (1775)

While the Revolutionary War was reshaping society and politics along the eastern seaboard, the Great Smallpox Epidemic was ravaging the entire North American continent from 1775 to 1782.



The Great White Plaque (1600s)

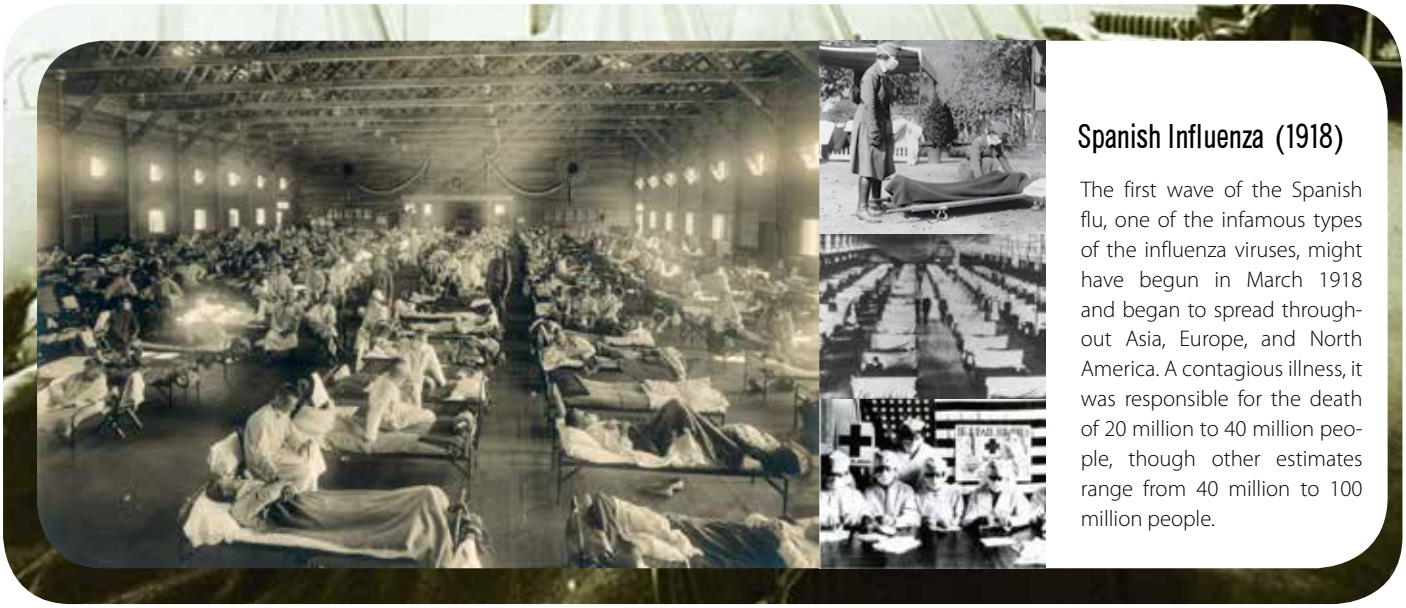
This tuberculosis epidemic in Europe during the 17th century lasted for nearly 200 years. It was the leading cause of death in 1650 and very likely propagated due to poor sanitary conditions and high population density characterizing most burgeoning cities.

Gujarat Earthquake (2001)

The 7.7 magnitude earthquake lasted for over 2 mins on India's 51st Republic Day celebration in 2001. Spread over 700km, the earthquake resulted in 20,000 deaths, 167,000 injured, 400,000 destroyed homes in 21 districts, and left 600,000 homeless.

The Black Death (1348)

An epidemic that swept through Europe from 1348 to 1351 killed an estimated 25 to 60% of Europe's population. Some estimates for the casualties of the Black Death were higher, which would mean somewhere between 75 million to 200 million people.



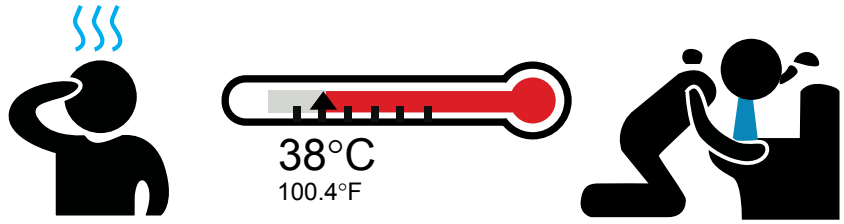
Spanish Influenza (1918)

The first wave of the Spanish flu, one of the infamous types of the influenza viruses, might have begun in March 1918 and began to spread throughout Asia, Europe, and North America. A contagious illness, it was responsible for the death of 20 million to 40 million people, though other estimates range from 40 million to 100 million people.

Source: List 25, New York Times, National Geographic

Facts About Ebola

Symtoms



Fever, weakness, muscle pain, headache and sore throat, followed by vomiting, diarrhoea, and bleeding

How to prevent

Isolate yourself and get medical care

Who?

- If you have been in an affected country

- Have had contact with a sick person you begin to have symptoms

Wash your hands with soap and water frequently

Handrub with alcohol -based hand sanitizer

How it Spreads

Direct contact with body fluids of an infected person (incl. dead bodies)-most infections: blood, faeces, vomit

Ebola is not Airborne

Unlike influenza or tuberculosis, Ebola does not spread through the air

People can survive Ebola

Although Ebola is a severe, often fatal illness, getting medical care early can increase the chance of Survival

For more details, please visit: *http://www.who.int/csr/disease/ebola/en/*

World Health Organization

How much do you know about Ebola?

1. Can someone without symptoms spread Ebola?

☐ Yes ☐ No

2. Is Ebola an airborne disease?

☐ Yes ☐ No

3. Can people survive from Ebola?

☐ Yes ☐ No

4. Can mosquitoes spread Ebola?

☐ Yes ☐ No

5. Can the Ebola virus survive in water and contaminate water and rivers?

☐ Yes ☐ No

6. I was in close contact with an Ebola infected person. How long should I check my health for?

☐ 7 days ☐ 14 days ☐ 21 days

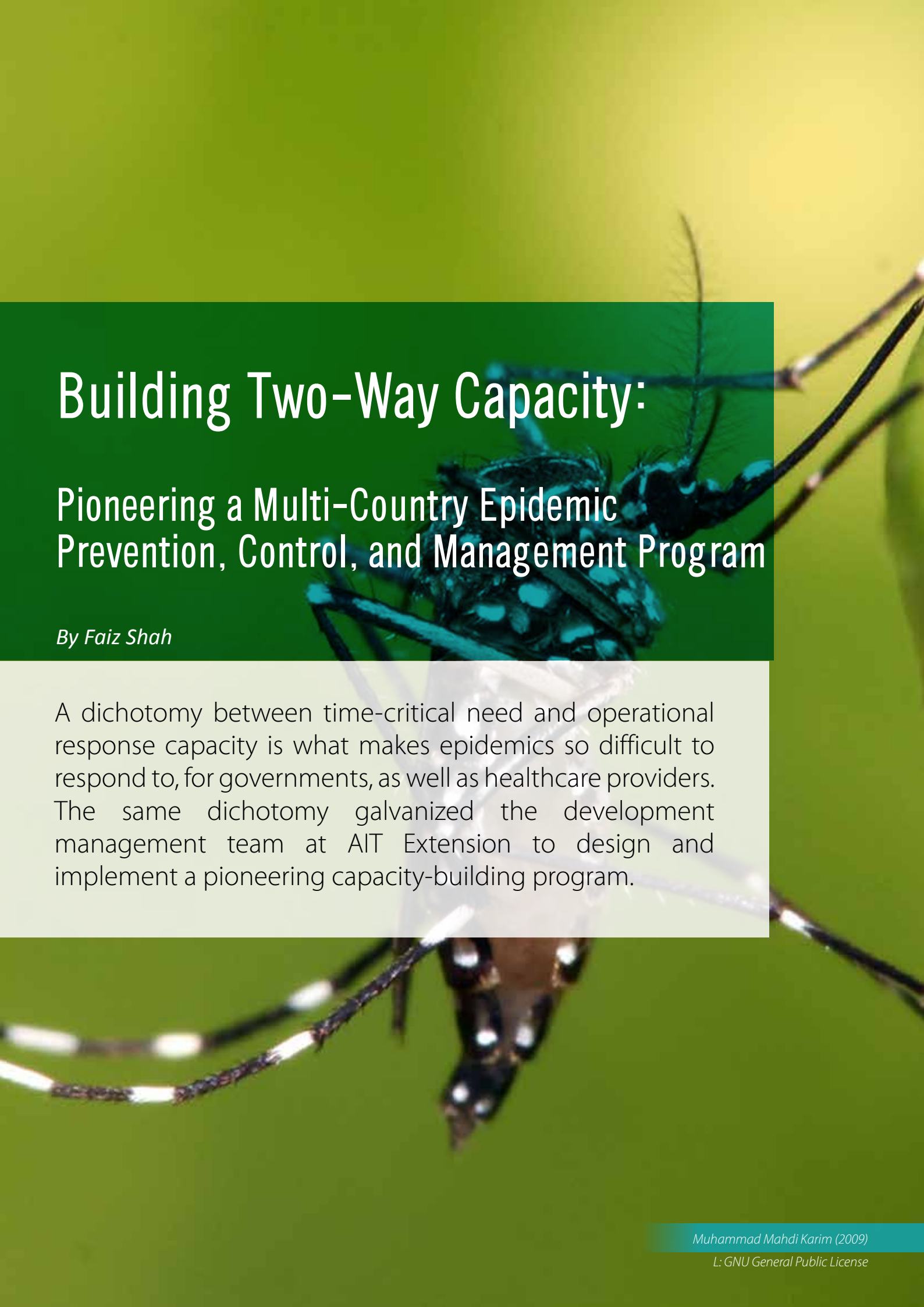
7. Can I get vaccinated for Ebola?

☐ Yes ☐ No

8. Can people who have died from Ebola infect others?

☐ Yes ☐ No

Answers on page 44.



Building Two-Way Capacity:

Pioneering a Multi-Country Epidemic Prevention, Control, and Management Program

By Faiz Shah

A dichotomy between time-critical need and operational response capacity is what makes epidemics so difficult to respond to, for governments, as well as healthcare providers. The same dichotomy galvanized the development management team at AIT Extension to design and implement a pioneering capacity-building program.

Building Two-Way Capacity:

Pioneering a Multi-Country Epidemic Prevention, Control, and Management Program

Natural disasters attract instant attention, and typically, an immediate and intensive response in support of relief and rehabilitation. A quick review of the major natural calamities in recent years brings to mind earthquakes in New Zealand (2011), Haiti (2010) or Kashmir (2005), which together claimed almost 350,000 lives and affected 5 million. Storms and tsunamis in recent memory, such as the ones in Eastern Japan (2011), Bay of Bengal-Nargis (2008), United States-Katrina (2005, and the Indian Ocean (2004) caused another 300,000 deaths, with another 4 million people directly affected.

These are indeed enormous human tragedies. The suffering they caused still lingers, particularly the disease and disability that came in the wake. But disease and disability are not confined to post-disaster situations. They stalk vulnerable populations relentlessly. In fact, disease outbreaks and epidemics kill and disable more people, and have devastated more communities than have natural calamities. A striking illustration comes from the First World War in which 16 million soldiers and civilians perished between 1914 and 1918. The Spanish Influenza pandemic between 1918 and 1919, meanwhile, extinguished 50 million lives between.

History records waves of bubonic plague epidemics killing half of China's population, then rampaging through India and Central Asia to strike Europe, to annihilate a third of continent's denizens. Smallpox, known since Pharaonic Egypt, is said to have wiped out the Aztec and Inca civilizations, claiming 60 million lives only in the century before it was finally eradicated in 1977.

Malaria and tuberculosis, known through history as killer diseases, continue to strike down huge populations. In 2012 alone, Malaria attacked 200 million people of whom 600,000 succumbed to it. During the same year, tuberculosis infected 9 million, of which 1.3 million did not survive. The H1N1 swine flu virus may have killed over 300,000 people during 2009-2010. Ebola in its most recent rage through West Africa has taken at least 9,000 lives.

Of the lesser known, but equally malicious public health challenges, is dengue fever. Endemic in 110 countries, dengue infects 100 to 400 million people annually, out of which over half a million can require hospitalization. Dengue can be life-threatening, particularly if it appears in its haemorrhagic or shock-syndrome form. Vaccines are said to be just round the corner, but until then, treatment is limited to ameliorating symptoms as the disease runs its course.

Transmitted through the bite of a common strain of the domestic mosquito, Aedes, which among its particular characteristics, has the ability to survive for months without water, and lay eggs in less than 5 millilitres of liquid, dengue remains a major challenge to public health managers. It has continued to climb higher on the list of high-risk epidemic diseases, with prevalence rising 30-fold since 1960, and could expose almost 2 billion by 2080.

Dengue epidemics have been recorded since the late 1700s, with the disease presently placing an estimated 2.5 billion people at risk for epidemic transmission. In Pakistan, dengue was first reported in 1994, but by 2005, the number of hospitalizations had gone from a mere 3 to just under 4,000, and 40 deaths. In 2011, this number peaked at over 21,000 cases, taking 365 lives before it became apparent that the Punjab was in the midst of the world's biggest ever dengue epidemic.

The Punjab health department quickly realized how unprepared its departments were for tackling the epidemic, trying to cope with panic referrals from an un-informed and under-equipped primary care system. Typically, media coverage increased public hysteria, straining an already overloaded hospital system to breaking point. Fortunately, health policymakers soon understood that controlling a ubiquitous vector-borne condition cannot depend on hospitalization alone, and that it is already too late to respond once symptoms appear.

Traditional approaches to prevention, control and management are made even more challenging in the case of Dengue because mass diagnostic screening methods remain non-specific and clinical assessment is often non-exclusive. The answer lies in designing and mounting a proactive public health initiative that is community-based, oriented to building mass awareness and behavior-change, and driven forward by inter-sectoral coordination, led by an effective disease surveillance apparatus. What stands in the way of this rather obvious solution is the manner in which healthcare service-delivery is administered. In a

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number of countries, the typical set up involves operational segregation of key mechanisms that determine the success of public health strategies.

More specifically, mass awareness, behavior-change, preventative measures, surveillance data, clinical triage, medical services and follow up, and most importantly proactive policy administration, are all in their own specific way, critical to the design and implementation of a successful public health program. However, each of these mission-critical elements are almost as a rule, administered as relatively independent, and often mutually de-linked departments, often working under different government ministries, with myriad priorities, budgets and operational competencies.

How AIT Extension acts as a Learning Organization, building internal competence while developing partner competencies

A - Opening program of DEPCAM with Thai Ministry of Public Health, Senior Expert Dr. Suchitra Nimmannitya, Department of Disease Control, Senior Medical Expert Dr. Supachai Rueknngam, Chef-de-Mission Mr. Sajjad Saleem Hotiana, and AIT's Dr. Willi Zimmermann. B - Dr. Suchitra Nimmannitya, Department of Disease Control. C - AIT Extension Executive Director Dr. Jonathan Shaw. D - Dr. Apinya Niramitsantipong, Thailand Department of Disease Control.

This dichotomy between time-critical need and operational response capacity is what makes epidemics so difficult to respond to, for governments, as well as healthcare providers. The same dichotomy galvanized the development management team at AIT Extension, AIT's professional development and outreach cluster to design and implement a pioneering capacity-building program that won appreciation from the highest levels in the host country, as well as the World Health Organization (WHO).

That the Dengue Epidemic Prevention, Control and Management (DEPCAM) program has been able to demonstrate AITE Extension's effective knowledge resource management skills is without question. What it has been able to showcase more importantly, is that learning organizations themselves learn as they teach, ramping up internal competencies for their own staff at the same time as they build client competencies.

An example of AITE's continuing efforts at building internal capacity to enhance AIT's development impact is the Dengue Epidemic Prevention, Control and Management (DEPCAM) Program designed for the Government of the Punjab, Pakistan, involving top Dengue experts from Thailand, Sri Lanka, and Pakistan.

Here is a chronicle of events. As AIT's inter-disciplinary knowledge hub, AITE has, over the years, offered a number of health-care trainings. During 2011, AITE's Development Management (DM) unit had worked to identify healthcare systems as a priority area for strengthening AITE's outreach capacity. Experts in peer institutions such as Chulalongkorn, Mahidol, Thammasat, and Chiang Mai universities, the Ministry of Public Health and the Bangkok Metropolitan Administration responded enthusiastically to AITE-DM's proposal for collaboration.

As a result of meetings with counterparts, AITE's Healthcare Resources Group (HRG) was created, with the aim of co-developing and delivering healthcare courses, including an advanced professional program in healthcare systems administration for the Government of the Punjab, which was a major contributor of participants to AITE's professional programs in governance and public affairs.

While on mission to Pakistan for introducing the professional programs, an AITE mission was summoned by the Chief Minister's office and asked for a proposal to combat dengue in Pakistan. AITE immediately presented a strategic capacity-building proposal to the Government of the Punjab. Upon return, AITE mobilized the nascent HRG and confirmed to the Punjab Government that their requirements for an integrated epidemic control and management training program could be met through AITE's existing expert resources.

The Bureau of Vector Borne Disease Control, Royal Thai Ministry of Public Health was contacted, who immediately identified locations and experts to join the HRG initiative. Professor Siripen Kalyanarooj, head of the WHO Regional Collaborating Centre for Dengue at the Queen Sirikit Institute, recognized pioneer in dengue management, who had visited Pakistan during the epidemic, offered to host a field placement, and also invite key resource-persons.

Discussion of epidemic control and management plans

Likewise, the chief epidemiologist at the Sri Lankan Ministry of Health whose unit had also visited Pakistan, agreed to host a bulk of the field placements in five hospitals around Colombo. The Punjab government deputed a senior member of the Chief Minister's Dengue Task Force as the academic coordinator for the visiting cohort, and appointed a senior permanent secretary to oversee AITE confirmed program faculty, and submitted a program schema in mid-October 2011.

An advance party from the Punjab comprising the Special Secretary and Director of the Punjab Resource Management Program (PRMP), and the Head of the Chief Minister's Dengue Research Program visited Thailand to meet faculty and visit training facilities in Bangkok, Chiang Mai, and Colombo, following which the DEPCAM program received approval from the Punjab Government, with a 6-week mobilization deadline.

The DM team immediately formed a coordination team comprising program officers from DM, Public Sector Capacity Building Program (PSCB), and AITE's administration unit, and inducted over a dozen program faculty, in field locations spread over long distances. Each identified location was assigned to a team member, who coordinated with identified government counterparts in ministries in Thailand and Sri Lanka. The Pakistan Embassy in Bangkok, as well as the Pakistan High Commission in Colombo offered active support during the preparatory phase.

The three professional cohorts comprising 126 participants, led by a permanent secretary arrived in Bangkok where they experienced an intensive learning schedule, with classes, field visits, and group work.

At the end of the first week, having completed Workshop I – Dengue Basics: A Public Health Perspective, the participants were moved to their respective field locations as part of three specialized groups, namely Clinical Case Management (Colombo); Research and Surveillance (Chiang Mai); and Behaviour Change and Response (Saraburi).

Participants working on their epidemic control and management plans.

During the second week, AITE hosted a policy-level cohort, comprising members of parliament, healthcare decision-makers, heads of healthcare training organizations and specialized hospitals, as well as representatives from NGOs, media and public service departments. This decision-making cohort went through a busy schedule of meetings and field visits to the public health nerve-centre of the Bangkok Metropolitan Administration as well as the municipality of Nonthaburi.

Opening ceremony of DEPCAM Policymakers Program.

The third week saw all cohorts return to Bangkok from their field placements and attend two more workshops, namely, Workshop II – Planning for Epidemic Control, and Workshop III – Transfer of Learning.

Lecture and discussion with Sri Lanka Ministry of Health Chief Epidemiologist Dr. Paba Palihawadana.

As deliverables for each of these workshops, participants produced drafts of tangible action plans, learning materials, and a brief presentation. These were assessed by senior program faculty in jury sessions. Tests were administered as part of a learning review session at the end of each week, matched by peer ranking through designated group coordinators. The highlight of the last day of the program was a planned live video-conference session where strategies and plans for managing the dengue epidemic were to be presented live to the Punjab Chief Minister. Certificates were distributed in a closing session.

Today, the dengue control strategies developed during DEPCAM in Bangkok, and implemented in Pakistan are recognized as being among the more effective high-impact capacity-building intervention in Pakistan. DEPCAM alumni continue to remain in touch with AITE, and continue to demonstrate the impact of a well thought through capacity-building program. Dr Firdosi Rustom Mehta, WHO Representative to Sri Lanka described DEPCAM as a working model of multi-agency inter-governmental cooperation worthy of wider replication. Apart from the public health impact that AITE was able to spearhead through a well- executed DEPCAM program, the program helped AITE create in-house capacity in an area that remains in high demand.

World Health Organization

VECTOR-BORNE DISEASES

VECTORS MAY BE A THREAT TO YOU, AT HOME AND WHEN TRAVELLING

VECTORS ARE SMALL ORGANISMS THAT CARRY SERIOUS DISEASES

COMMON VECTORS

WITH JUST 1 BITE they can transmit diseases such as:

- Malaria
- Dengue
- Leishmaniasis
- Lyme disease
- Yellow fever
- Japanese encephalitis

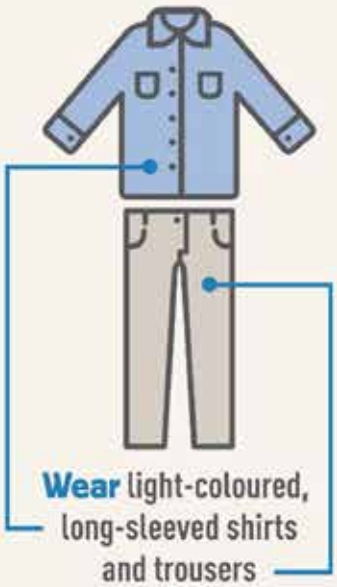
Diseases spread by vectors **kill a million people** every year and **more than half of the world's population is at risk**

TAKE SIMPLE MEASURES TO PROTECT YOURSELF AND YOUR FAMILY

Get vaccinated against yellow fever and Japanese encephalitis

Install

window screens



Wear light-coloured, long-sleeved shirts and trousers

Use **insect repellent**

Sleep under an **insecticide-treated bed net**

Get rid of stagnant water from places **where mosquitoes breed,** such as in old containers, flower pots and used tyres

For more information **www.who.int/**

Sea Erosion in India
SL Shanth Kumar, 2014

Insights for Climate Resilient Infrastructure

Author:

Marco Silvestri
Programme Specialist, AIT Regional Resource Centre for Asia and the Pacific (RRC.AP)

While there are efforts being made within Asian countries to minimize environmental hazards and their associated health risks, populations are also becoming more exposed to increasing occurrences of disasters in the region. These include recent disasters from climate-induced natural hazards (such as typhoons and floods) and health emergencies related to poor resilience of infrastructure facing natural disasters. The Asian Tsunami left hundreds of thousands of people without access to safe water and sanitation; the outbreaks of SARS and Avian Influenza which later occurred were partly attributed to inadequate environmental sanitation. In addition, with rapid industrial development, the number of technological emergencies, involving chemicals and radiation, is increasing. Economic damage from natural disasters in Asia is high compared with other regions, while investment in infrastructure is low (currently 3-4% of GDP). All these emergencies threaten human life and public health while recovery following disasters remains a challenge, a key reason being that interventions often do not address underlying drivers of vulnerability such as political marginalization and insecure rights.

Building resilience to disasters requires actions across sectors and administrative boundaries, and special attention to the disempowered poor. Infrastructure plays a key role as it is required all the time among every human community. Adequate and robust water supply and sanitation provision are fundamental to resilient development; infrastructure can provide shelter from disasters and ensure transportation and communications for effective response. Climate-related risks are not entirely new, but rather more severe and/or more frequent iterations of long-standing risks. Infrastructure solutions should therefore be safe-to-fail, and not assumed to be fail-safe. Vulnerability assessments need to be incorporated into project feasibility studies. Transport limitations in the Mekong Delta are a significant constraint on trade and development; ADB feasibility studies to increase transportation speeds suggested building several bridges. Climate change poses significant risks to such infrastructure, and governments have adjusted designs based on vulnerability assessments – for example, by increasing anticipated flood levels.

Urbanization has direct impacts and strong links with vulnerability and resilience. Millions of residents in coastal urban areas are increasingly vulnerable to disasters, and many local governments do not have the means to build protective barriers. The alternative is to think about infrastructure planning in a different way, investing to build infrastructure in rural areas in order to reverse certain

Tonle Sap Stilt House, Cambodia
John Lander, 2014

patterns of rural-urban migration. This transformative strategy in migration processes is important especially in addressing the way urbanization transforms ecological landscapes and ecosystems, in addition to movements of people and resources. Ecosystem-based adaptation is in fact an int eresting alternative to hard infrastructure. Green infrastructure (GI) is an interconnected network of open and green spaces, both natural and designed, that can provide multiple functions and services such as water and air purification, aesthetics, cultural and socio-economic benefits, recreation, and wildlife habitats. It is important for water-related adaptation, as it allows for increased infiltration and reduces run-off (and thus, flood risks).

Resilient infrastructure can then be identified by several attributes: 1) independence, decentralization, and renewable technologies, 2) resource efficiency across the full life-cycle, 3) international standard designs to mitigate risks, 4) green infrastructure, 5) locally based implementation modalities, 6) avoidance of maladaptation, 7) rapid recovery capacity, 8) safe failure intended as being able to fail safely, without triggering a cascade effect, and 9) ability to reorganize, adapt and shift. Multi-hazard risk assessments should be a useful tool to gauge the resilience of the region's infrastructure; more difficult but also important to assess are the interdependencies between infrastructures. It is crucial to ensure that engineers as well as infrastructure owners and managers consider climate change as an integral part of planning, designing, constructing, operating, maintaining and rehabilitating civil infrastructure, planning ahead for likely climate-induced disasters. Capacity building is necessary to increase and create skills among the different stakeholders, involved in both the technical and policy/planning aspects of infrastructure development.

With contributions from Jonathan Shaw, Ph.D., Director, AIT Extension, Asian Institute of Technology and Deputy Director, Regional Resource Centre for Asia and the Pacific (RRC.AP).

The Asia Pacific Climate Change Adaptation Forum is among the largest climate change adaptation events in the Asia-Pacific region. Since 2010, four Forums have been co-organised by the Asia Pacific Adaptation Network (APAN). APAN operates through its regional hub located in Bangkok and its four core partners which are the Institute of Global Environmental Strategies (IGES), the Stockholm Environment Institute (SEI), the United Nations Environment Programme (UNEP), and AIT's Regional Resource Centre for Asia and the Pacific (RRC.AP). The insights provided by the authors are reflective of the knowledge exchanges that transpired among the speakers and participants around the theme of climate resilient infrastructure.

Photos: *Courtesy of the Asia Pacific Adaptation Network (APAN).*

Find out how much you know about Ebola on page 22.

Answers:
How much do you know about Ebola?

1. No	3. Yes	5. No	7. No
2. No	4. No	6. 21 days	8. Yes

AIT News Brief

Jul 2014

AIT welcomes new President, Prof. Worsak Kanok-Nukulchai

The Asian Institute of Technology (AIT) welcomed the new President, Prof. Worsak Kanok-Nukulchai, on 17 July 2014 during the annual AIT Board of Trustees meeting.

Prof. Worsak is the 7th President was will serve a term of four years. Prior to his appointment, Prof. Worsak served as AIT Interim President since 1 July 2013 and had also served as Acting President from 13 February - 3 March 2013, and then from 1 April - 30 June 2013.

Prof. Worsak is the first AIT alumnus, first Asian, and first Thai national to be selected as the president of AIT in its fifty-four year history. In his highly accomplished career, Prof. Worsak served AIT in a number of capacities. He served as Dean of the former School of Civil Engineering and was the founding Dean of the School of Engineering and Technology. Prof. Worsak also served as AIT Vice President for Resource Development for a period of four years beginning in July 2009.

May 2014

ASEP Convention Focuses on Extreme Loadings on Concrete Structures

Dr. Naveed Anwar accepts certificate of appreciation from ASEP President Carlos Villaraza

The Association of Structural Engineers of the Philippines, Inc. (ASEP) held its 4th ASEP convention on Concrete Engineering Practice and Technology (a.concept'14) with the theme, "Extreme Loadings on Concrete Structures," on 22-24 May 2014 at Century Park Hotel, Manila, Philippines.

This three-day event focused on extreme loadings on concrete structures in response to the natural disasters the Philippines experienced from September to November 2013.

a.concept'14 featured timely presentations from renowned structural engineers in the Philippines. The keynote speaker of the event was Hon. Alfredo Arquillano, Jr., Vice-Mayor of San Francisco, Cebu and is an acclaimed UNISDR Champion "Making Cities Resilient." He shared detailed about his winning work "Purok System" that empowers local communities in reducing disaster risks and adapting to climate change.

Speakers presented topics such as the results of the investigation of historical structures after the Bohol earthquake, review of school buildings after the Bohol earthquake, seismic analysis and retrofitting of concrete buildings, strengthening method of concrete members, storm surge-wave inundation on the typhoon Yolanda (Haiyan) field survey, updated wind zone and contour maps: adaptation strategies for extreme wind speeds, among others.

One of the speakers, Dr. Naveed Anwar, Executive Director of AIT Consulting, discussed the strategies and techniques for seismic risk reduction of school buildings in developing countries. Dr. Naveed, while in the in the Philippines, also met with UNESCAP and Hilti Foundation representatives to discuss collaborative partnerships in developing strategic solutions for sustainable and disaster-resilient buildings.

Aug 2014

AIT Partners with Prashak Techno Enterprises for Intellectual Property Rights of Innovative Habitech Technology Solution in India and Other Countries

(L-R) Dr. Siddarth Jabade, Dr. Praful Naik, Prof. Worsak Kanok-Nukulchai, Dr. Naveed Anwar, Engr. Gyanendra Sthapit during the MoU signing

The Asian Institute of Technology's Habitech Center, through AIT Consulting, signed a Memorandum of Understanding (MoU) with Prashak Techno Enterprises, India. This collaboration between AIT Consulting/Habitech and Prashak is in terms of joint participation in generating, creating, and developing intellectual property and protection of such intellectual property by filing and maintaining of patents and other forms of intellectual property protection apart from grant of licensing rights to Prashak for use of such developed and protected intellectual property in designated countries/ regions.

The MoU stipulates that AIT grant licensing rights to Prashak for use and deployment of the intellectual property protected Habitech Technology in commercial projects, apart from promoting the technology for securing potential projects in India and other countries. Prashak has since then filed the core patent application on behalf of AIT and is also responsible for actively maintaining AIT's Intellectual Property Rights on the novel cost-effective sustainable housing technology in all countries where the patent applications will be filed for protection of the intellectual property. Prashak's CEO, Dr. Praful Naik is also one of the co-inventors of the novel housing technology solution. AIT and Prashak are currently collaborating on a prospective project in Nigeria which will utilize the innovative Habitech building technology solutions in a wide-scale community-level application.

This unique partnership between Prashak and AIT Consulting through Habitech was initiated by Dr. Siddarth Jabade who was previously the Director of AIT's Innovation and Intellectual Property Rights, housed at AIT Consulting. Under the technical guidance of Engr. Gyanendra Sthapit, the Habitech Building System is now increasing applications and potentials for adaptations into novel and innovative building technology solution that is green and sustainable, disaster-resilient, and durable. The key to the solution's value proposition includes focusing on using simple, replicable techniques, and local resources while remaining cost-effective.

CSI Brings Theory and Practice of Performance-based Design: The Future of Earthquake Engineering to Thailand

The Computers and Structures, Inc. (CSI), USA, in collaboration with the Asian Center for Engineering Computations and Software (ACECOMS) through AIT Consulting, Asian Institute of Technology (AIT) brought the Theory and Practice of Performance-based Design (PBD): The Future of Earthquake Engineering to Thailand. This world class event was previously held in San Francisco, New York City, Los Angeles, and Shanghai for the benefit of the building and construction industry and the engineering professionals in the region.

The seminar, held on 7 August 2014 at the Sofitel Bangkok Sukhumvit, attracted more than 150 participants from 72 organizations from countries including Cambodia, India, Lao PDR, Myanmar, Philippines, Singapore, and Thailand.

From left: Syed Hasanain Muzami, Executive Vice President, CSI; Dr. Naveed Anwar, Executive Director, AIT Consulting; Marilyn Wilkes, Senior Vice President, CSI; Ashraf Habibullah, President and CEO, CSI; Dr. Nazim Latif, Commercial Counselor, Embassy of Pakistan to Thailand; and Prof. Sivanappan Kumar, Vice President for Academic Affairs, AIT

Dr. Naveed Anwar, Executive Director, AIT Consulting welcomed the participants of the seminar and introduced the keynote speaker Ashraf Habibullah, President and CEO, CSI.

Mr. Ashraf Habibullah, President and CEO, CSI, expressing his invaluable views on seismic safety and tall buildings during the seminar.

Prof. Pennung Warnitchai, AIT School of Engineering and Technology opened the seminar with a presentation of the latest structural engineering research being conducted at AIT concerning earthquakes and wind. He also discussed the seismic risks in Thailand and the region, as well as the various work of AIT researchers to improve designs to mitigate the impact of these natural hazards.

Find out more about the event, visit: http://consulting.ait.ac.th/CSIEvent.aspx

Green Technology Workshop 2014 Features Solutions, Technologies, and Best Practices for Green Building and Manufacturing

Participants who attended the workshop came from recognized organizations including Betagro Group, Chevron Thailand Exploration and Production, Ltd, Dinthong Corporation Co. Ltd, FSE Consultant Co. Ltd., SCG Building Materials Co. Ltd, Tawan Energy Co. Ltd, Regional Resource Centre for Asia and the Pacific. Limited seats were also provided to selected students from the School of Environment, Resources and Development (SERD) and School of Engineering and Technology (SET), AIT.

The Asian Institute of Technology (AIT) organized a focused event on green technology building on a similar topic that was discussed during the AIT Technology Event held in 2013.

The Green Technology Workshop 2014 was held on 28-29 August 2014 at the AIT Conference Center to provide a platform for both public and private sectors in the field of buildings and manufacturing industry to discuss, interact, network, and discover innovations and best practices in policy, and technology, and best practices to achieve holistic success in sustainability efforts.

The workshop featured several presentations from renowned experts in the field of energy, environment, and green building including: Dr. Brahmanand Mohanty, Visiting Faculty, School of Environment, Resources and Development, AIT; Dr. Prasad Modak, Executive President, Environmental Management Centre LLP and Director, Ekonnect Knowledge Foundation, India; Dr. Atch Sreshthaputra, Executive Committee, Thai Green Building Institute and Assistant Professor, Chulalongkorn University, Thailand; and Prof. Chettiyappan Visvanathan, Dean, School of Environment, Resources and Development, AIT. Prof. Sivannapan Kumar, VP for Academic Affairs, AIT, joined as one of the panel experts along with Dr. Modak, Prof. Visvanathan, Dr. Sreshthaputra, during panel discussion and Q&A session.

Environmental management expert Dr. Prasad Modak, Executive President, Environmental Management Centre LLP and Director, Ekonnect Knowledge Foundation, India presented three topics: green evolution, how to adopt management systems in organizations, and design and manufacturing for sustainability.

Energy management expert Dr. Brahmanand Mohanty covered topics such as managing resources using integrated approach to energy and water conservation. He presented several case studies to provide participants with clear understanding on the importance and benefits of green practices.

Environmental Engineering Expert Prof. Chettiyappan Visvanathan, Dean, School of Environment, Resources and Development, AIT gave two presentations. The first presentation was on managing waste and emissions from manufacturing industries and building while the second focused on industrial symbiosis (eco-industrial cluster).

Green building expert Dr. Atch Sreshthaputra, Executive Committee, Thai Green Building Institute and Assistant Professor, Chulalongkorn University, Thailand explained the emerging green process/system called the Building Information Modeling (BIM) that the building industry is now adopting to achieve holistic success in green design and construction.

Prof. Sivannapan Kumar, VP for Academic Affairs, AIT, joined as one of the panel experts along with Dr. Modak, Prof. Visvanathan, Dr. Sreshthaputra, during panel discussion and Q&A session moderated by Dr. Mohanty.

In collaboration with Ekonnect Knowledge Foundation, India, the workshop also featured two parallel field visits wherein participants were provided a choice between visiting either the Bangpa-In Industrial Estate or the Thai Health Promotion Office. In Bangpa-In Industrial Estate, participants learned the practical aspects covered previously specifically in managing wastewater and industrial emissions. In Thai Health Promotion Office, a LEED (Platinum) certified building, participants learned various bio-climactic design and green building features.

Find out more about the event: ***http://consulting.ait.ac.th/greentechevent.aspx***

UNESCAP Conducts National Workshop on Sustainable Urban Infrastructure Development in the Philippines

Speakers Mr. Edilberto Paradela, Regional Director, Department of Science and Technology Region 7; Dr. Carol M. Yorobe, Undersecretary for Regional Operations, Department of Science and Technology; Dr. Donovan Storey, Chief, Sustainable Urban Development Section, Environment and Development Division, ESCAP; Hon. Mr. Mario G. Montejo, Secretary, Department of Science and Technology; Dr. Ram Tiwaree, Economic Affairs Officer, Sustainable Urban Development Section, Environment and Development Division, ESCAP; Mr. Cris Cyril C. Abbu , Architect, Chora Design and Architects, and ESCAP resource person; Ms. Sakai Yuko, Japanese International Cooperation Agency, Mega Cebu; and Ms. Benita Ochoa Regala, National President United Architect, National Housing Authority of the Philippines; and Dr. Naveed Anwar, Executive Director, AIT Consulting with the participants after the workshop.

The United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP), in collaboration with the Department of Science and Technology (DOST), Philippines conducted the National Workshop on Sustainable Urban Infrastructure Development in the Philippines on 10-11 September 2014 at Dusit Thani Hotel, Manila.

This workshop is part of a series of capacity building activities targeting policy makers in developing countries in the region involved in infrastructure design and planning, especially water and energy infrastructure. The capability building activity is one of the key activities for the project "Pilot Implementation of Low Carbon Green Growth Roadmap for Asia and the Pacific" targeting Mongolia, Nepal, the Philippines, and ASEAN countries. Emphasis on enhancing the capacity of policy/decision-makers in developing countries in the region was prioritized to assist in formulating and applying policy options that improve the quality of growth and formulate and apply policy options that help achieve internationally agreed development goals (IADGs) and millennium development goals (MDGs) in the area of water resources management (UNESCAP, June 2014).

In line with this, UNESCAP engaged the services of the Asian Institute of Technology (AIT) through AIT Consulting (AITC) to assist in developing a concept paper that would link the concept of sustainability to disaster-resiliency in school buildings and further incorporate these priorities in updating building codes for schools. Disaster Risk Management Expert, Dr. Naveed Anwar, Executive Director of AITC, presented the concept paper "Regional Policy on Integrating E-sustainability, and Resilience in School Building Development and Its Implications in the Philippines," during the workshop.

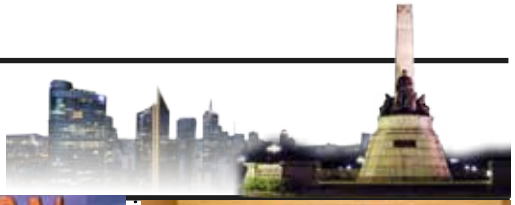
Myanmar Engineering Society Hosts the CAFEO 32

Myanmar Engineering Society (MES) hosted the "Conference of the ASEAN Federation of Engineering Organizations" (CAFEO-32) held on 9-12 November 2014 at Sedonoa Hotel, Myanmar. CAFEO is an annual conference organized by the distinguished ASEAN Federation of Engineering Organizations, with one of the member organizations selected as host.

The conference's theme this year focused on integrated solutions for energy, transport, and infrastructure. Over 500 engineers from different countries attended the event, all coming to share and learn expertise and experiences in the following topics: infrastructure development in transportation & energy; ASEAN connectivity, infrastructure development, ICT; urban transport for competitive city; energy cooperation ASEAN power grid, trans-ASEAN gas pipeline; renewable energy sources: solar, wind, biomass, bioenergy; rural electrification development ;engineering and technology for infrastructure development; engineering education, research and innovation.

Engr. Thaung Htut Aung, Deputy Projects Director, AIT Consulting, presented a paper on "Case Study: Performance-based Design of Ductile Core Wall Building." While in Myanmar, Engr. Aung also visited AIT Consulting's projects together with AIT Consulting consultant Mr. Saw Htwe Zaw. They verified the construction status of Diamond Inya Palace Building and Yangon Grand Hotel on 13 November 2014.

CSI and ASEP Organizes the Theory and Practice of Performance-based Design in Manila, Philippines



ASEP officers and members with Ashraf Habibullah, President and CEO of CSI and Syed Hasanain Muzami, Executive Vice President, CSI

Over 280 participants drawn from public and private sectors comprised of engineers, architects, executives, managers, and directors attended the biggest PBD event in the Philippines organized by Computers and Structures Inc. (CSI) in collaboration with ASEP and Asian Center for Engineering Computations and Software (ACECOMS) at the Asian Institute of Technology (AIT).

The Theory and Practice of Performance-based Design (PBD): The Future of Earthquake Engineering was held on 7 November 2014 at the Crowne Plaza Manila Galleria, Philippines following the request from some members of the Association of Structural Engineers of the Philippines (ASEP) during the PBD Bangkok seminar.

Engr. Carlos M. Villaraza, ASEP President delivered the opening remarks.

Keynote speaker Ashraf Habibullah, President and CEO of CSI, delivered four-part lectures on the benefits of PBD especially in earthquake-prone country like the Philippines.

Dr. Naveed Anwar, Executive Director, AIT Consulting introduced the keynote speaker Ashraf Habibullah, President and CEO, CSI.

Engr. Carlos M. Villaraza, ASEP President presented the topic "A Step-by-step Procedure on Performance-based Design of 40-story Reinforced Concrete Building (Overall Procedure)" during the hands-on training on 8 Nov.

Engr. Mir Shabir Ali Talpur, Senior Project Engineer, AIT Consulting and Engr. Thaung Htut Aung, Deputy Project Director, AIT Consulting answering questions during the hands-on session.

A hands-on session was conducted on 8 November by ASEP and ACECOMS, AIT to provide hands-on demonstration of PBD. The seminar covered topics including: A General Approach in the Determination of Two Level Earthquakes for Performance-Based Earthquake Engineering Design by Engr. Carlos M. Villaraza, ASEP President; A Step-by-step Procedure on Performance-based Design of 40-story Reinforced Concrete Building (Overall Procedure) by Engr. Thaung Htut Aung, Deputy Project Director, AIT Consulting; and A Step-by-step Procedure on Performance-based Design of 40-story Reinforced Concrete Building (Detailed Modeling, Analysis and Evaluation) by Engr. Mir Shabir Ali Talpur, Senior Project Engineer, AIT Consulting.

Eight-Japan Engineering Consultants Inc. (EJEC) Visits AIT to Strengthen Collaboration

Eight-Japan Engineering Consultants Inc. (EJEC) visited the Asian Institute of Technology (AIT) on 12 November 2014 to further foster its partnership with the Institute.

Led by Mr. Yugi Kotani, EJEC President, the exploratory meeting covered areas of possible collaboration particularly in the field of structural engineering, earthquakes and tsunami, risk assessment, disaster management, infrastructure design, waste management and renewable energy, where AIT shows considerable experience and expertise. EJEC's main business areas include road and transport planning and design, urban and regional planning, water resources development and water supply, waste management, environment, disaster mitigation and facility maintenance, information, instrumentation and compensation, and geo-engineering.

The delegation was in the kingdom primarily to launch EJEC's headquarters in Thailand and were looking to strengthen relations with AIT to add to EJEC's generous scholarship grants formally established in September of this year. EJEC officials visited the AIT Consulting office and met with Dr. Naveed Anwar who introduced AIT Consulting's expertise and services through a detailed presentation of several global applications of AIT's technical adroitness. The attendees of the meeting included Mr. Kotani along with other EJEC officials Dr. Ryoji Isoyama, Executive Director; Mr. Yukiyoshi Kawajiri, Executive Director; Mr. Atsuyuki Nakaseko, Head of International Department; Mr. Kazuo Yakata, President, EJ Business Partners Co., Ltd.; Mr. Sakae Nakamura, Representative Office Manager, Bangkok and Representative Office; Ms. Erina Kan, Engineering staff, International Department; Mr. Taisuke Odera, Representative, Bangkok and Representative and the AIT team comprised of the AIT Vice President for Resource Development Prof. Kazuo Yamamoto, Prof. Pennung Warnitchai, representing the School of Engineering and Technology (SET), and Dr. Gabrielle Groves, Head, External Relations and Communications Office (ERCO).

Nov 2014

AIT Joins Arup's Future of Rail 2050 Presentation

From left: Prof. Somnuk Tangtermsirikul, Director, Sirindhorn Int'l Institute of Technology; Dr. Somprasong Suttayamully, Acting Director, MRTA; Dr. Naveed Anwar, Executive Director, AIT Consulting; Dr. Rithika Suparat, Asst. Governor, MRTA; H.E. Mark Kent, British Ambassador to Thailand; Tawatchai Suthiprapha, Senior Executive VP, Italian-Thai; Sindhu Pulsirivong, Chairman, SMC Group; Timothy Suen, Arup, Director, Hong Kong; Jason Simpson, Arup, General Manager, Thailand

The Asian Institute of Technology (AIT) was invited to attend a special presentation on the Future of Rail 2050 organized by Arup and supported by UK Trade and Investment held on 21 November 2014 at the InterContinental Hotel Bangkok.

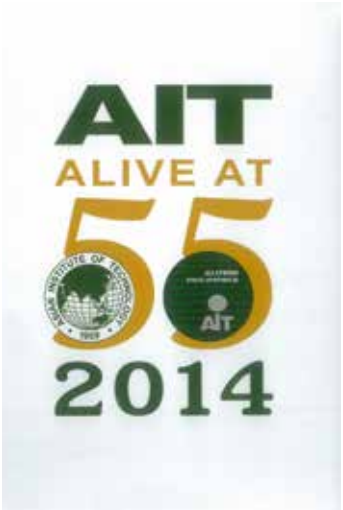
The Future of Rail 2050, presented by Timothy Suen, an Arup Fellow and East Asia Rail Group Leader, is a thought paper created by ARUP Rail and Foresight + Research + Innovation with relevant inputs from contributors from around the world. The presentation focused on the passenger's perspective on how railway trends will affect the way we live, work, and travel in the future.

The event also featured a presentation on the Transit Oriented Planning for the Future by Sam Chow, Director of Consulting, East Asia Transport Consulting, and a panel discussion that focused on the innovations, developments, and connectivity of the future rail in 2050.

Dr. Naveed Anwar, Executive Director, AIT Consulting, one of AIT's representatives in the event, discussed AIT's strengths with Jason Simpson who showed interest in AIT's broad expertise in the region. It was decided that Mr. Simpson will visit the Institute, upon Dr. Naveed's invitation to further discuss possible collaboration on mutually-aligned areas of interests.

Nov 2014

AIT Releases Commemorative Book "AIT Alive at 55"



A commemorative book titled "AIT Alive at 55" documenting the Asian Institute of Technology's (AIT's) rich fifty-five-year history was launched in November 2014 by the AIT's Alumni Association (AITAA) Philippine Chapter. The publication was unveiled to the public at an open-air ceremony at De La Salle University in the presence of Thailand's Ambassador to the Philippines H.E. Mr. Prasas Prasasvinitchai, Chairman of the AIT Board of Trustees H.E. Dr. Subin Pinkayan, and AITAA President Mr. Thanin Bumrungsap, and was later signed by former President of the Philippines HE. Fidel V. Ramos, who is an honorary AIT alumnus and was the keynote speaker at the annual AIT alumni gathering.

Headed by editor-in-chief Mr. Joseph Siangho, AITAA Philippine Chapter President, the book's release was held during the 43rd Board Meeting (GBM) held on 21 November 2014. The book opens with "Building a Dream," a chapter taken from the book of the same title by prominent Filipino alumnus and Hall of Famer Prof. Ricardo P. Pama. This chapter takes the readers to AIT's history from 1959 to the present and ends with optimistic messages for the future. The Royal Thai Embassy in the Philippines and the Ministry of Foreign Affairs, Thailand funded the book with the help from a number of private and public sector partners and individual sponsors, including AIT Extension and AIT Consulting.

Thailand's National Housing Authority Governor Inaugurates AIT Workshop on Innovative and Cost-effective Solutions for Cleaner, Greener, and Safer Communities

The Asian Institute of Technology (AIT) through Habitech Center and AIT Consulting organized a seminar and workshop to share innovative technology solutions for low-cost housing. Carrying the theme "Building Cleaner, Greener, Safer, and Cost-Effective Communities," the event welcomed over 70 participants from eight countries on 27-28 November 2014 at AIT.

The event brought together over 30 organizations from countries including Bangladesh, India, Laos PDR, Myanmar, Nepal, Oman, Philippines, and Thailand. Participants were comprised of engineers, architects, directors, executives, managers, professors, researchers, and students from the public and private sectors, and universities.

The workshop featured presentations from renowned building and social housing experts including: "Low-cost Housing Challenges and Considerations" by Dr. Naveed Anwar, Executive Director, AIT Consulting; "Technology Solutions for Low-cost Housing Being Used in NHA" by Ms. Sukumaporn Jongpukdee, Deputy Director, Department of Policy and Planning, National Housing Authority (NHA), Thailand; "Regional Practices on Low-cost Housing" by Dr. Ram Tiwaree, Economic Affairs Officer, Sustainable Urban Development Section, Environment and Development Division, UNESCAP; "Interlocking Blocks Solutions and Systems for Low-cost Building" by Gyanendra Sthapit, Director, Habitech Center, AIT; "Design Examples of Low-cost Housing" by Ms. Sudiksha Amatya, Senior Architect, AIT Consulting; "Ferrocement for Low-cost Housing" by Dr. Sun Sayamipuk, Managing Director, S N Service Solutions Co., Ltd.; "The Ecovillage Rating System" by Dr. Atch Sreshthaputra, Executive Committee, Thai Green Building Institute; and "Intact Structures Design Low-cost Durable Ferrocement Housing Systems" by Mr. Owen Waldschlagel, Founder and Designer, Intact Structures Inc.

The second day featured field visits to AIT's Habitech Center and Ferrocement Park for hands-on demonstration of the technologies covered in Day 1. Visits to onsite Habitech projects including the AIT International School and the NHA project at Baan Eau-Arthorn Rojana were also arranged to illustrate the effectiveness of this homegrown solution.

The workshop was presided over by chief guest Mr. Krisda Raksakul, Governor, National Housing Authority (NHA), Thailand, who conveyed his appreciation to AIT and indicated his support towards advancing the concept of sustainable housing development.

AIT Vice President for Academic Affairs Prof. Sivanappan Kumar delivered the opening address on behalf of AIT President Prof. Worsak Kanok-Nukulchai. As a renowned renewable energy expert, Prof. Kumar emphasized the importance of building clean and green housing for the development of the Asia-Pacific region.

Prof. Sivanappan Kumar and Mr. Krisda Raksakul during the opening ceremony of the workshop.

Some participants from Lao PDR and the Philippines

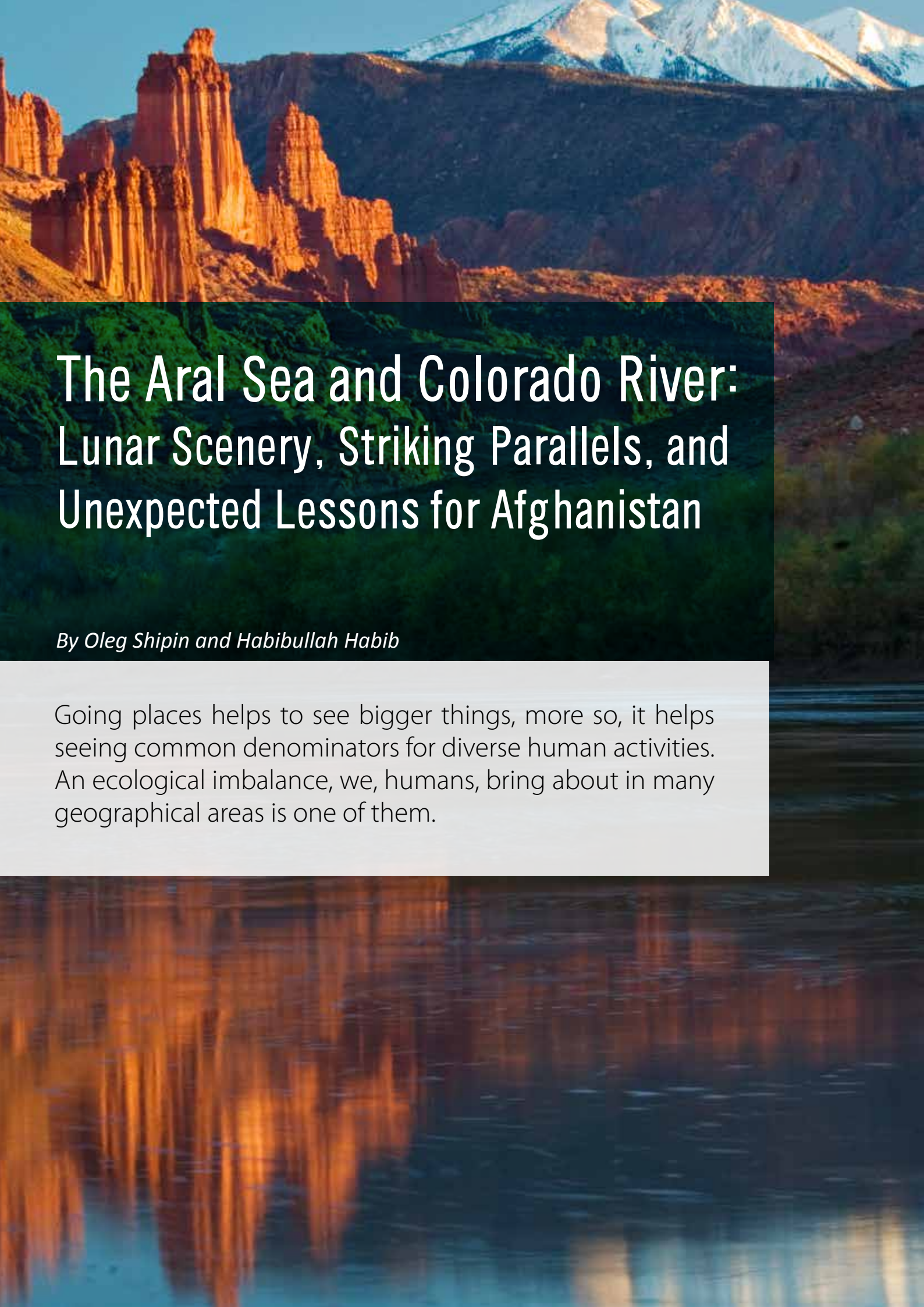
Selected participants from the Ministry of Construction, Myanmar, SCG Thailand, UN-Habitat Nepal, and the India Centre for Public Policy Birla Institute of Management Technology, were invited to join the panel discussion to share their views, experiences, and solutions related to the topics covered in the workshop, together with speaker Dr. Atch Sreshthaputra and moderated by Dr. Naveed Anwar

Site visit at the Habitech and Ferrocement Park

Hands-on demonstration at Habitech Center

Site visit at NHA's Baan Eau-Arthorn Rojana

For more details, please visit: http://consulting.ait.ac.th/socialhousingevent.aspx



The Aral Sea and Colorado River: Lunar Scenery, Striking Parallels, and Unexpected Lessons for Afghanistan

By Oleg Shipin and Habibullah Habib

Going places helps to see bigger things, more so, it helps seeing common denominators for diverse human activities. An ecological imbalance, we, humans, bring about in many geographical areas is one of them.

The Aral Sea and Colorado River: Lunar Scenery, Striking Parallels, and Unexpected Lessons for Afghanistan

Going places helps to see bigger things, more so, it helps seeing common denominators for diverse human activities. An ecological imbalance, we, humans, bring about in many geographical areas is one of them. In search of such an unfortunate denominator a group of environmental experts, comprising two Afghans from Balkh University (Mazar-e-Sharif, Afghanistan), and the project leader from the Asian Institute of Technology (AIT) visited one of the world's major environmental disaster areas – the drying Aral Sea in Central Asia. The group assists British Council's DelPHE program to build capacity for water protection in Northern Afghanistan through Strategic Environmental Assessment, also known as Strategic Environmental Impact Assessment (SEIA). The trip was inspired by work of the Amu Darya Basin Network established by the East West Institute in Brussels. Logistics were facilitated by Berdakh and Marat Utemuratovs from Karakalpakstan, the area of western Uzbekistan most affected by water shortage.

In the second half of twentieth century, the Aral Sea "unexpectedly" fell prey to a voracious appetite of human development machine requiring ever-increasing volumes of cotton. The monoculture was notorious for excessive water consumption imposing an unsustainable water burden on Amu Darya, the river, which feeds the sea. Post-Soviet imbalances between energy and irrigation needs in Central Asia further offset the precarious desert equilibrium. On top of this, the situation was possibly exacerbated by a natural fluctuation of water resources in the region, decreasing at the period while the neighboring Caspian Sea level rose.

Three Soviet republics were a closed club of large-scale users of Amu Darya water. Nowadays, after decades of absence, Afghanistan gradually, but inevitably, comes back to the club. Complex multilateral negotiations still lie ahead. But the historic Aral Sea trip by Afghan scholars paves the way towards a dialogue between people of the upstream and downstream. Strategic water security is one of the keys to emerging long-term stability in Afghanistan. Strategic Environmental Assessment (SEA) would serve the purpose of ensuring that water resources for regional and Afghan agriculture uses are sustainable in the long run. Afghan water environments (rivers, underground kareze, irrigation canals, and natural wetlands) are stressed due to a long period of conflict. To avoid environmental collapse the post-conflict country is in need of strategic environmental planning. SEA offers an effective procedure for evaluating likely adverse or positive environmental impacts of proposed development projects, plans, and policies. By identifying ways of improving project selection, planning, design, and implementation, it enhances the quality and sustainability of human activities.

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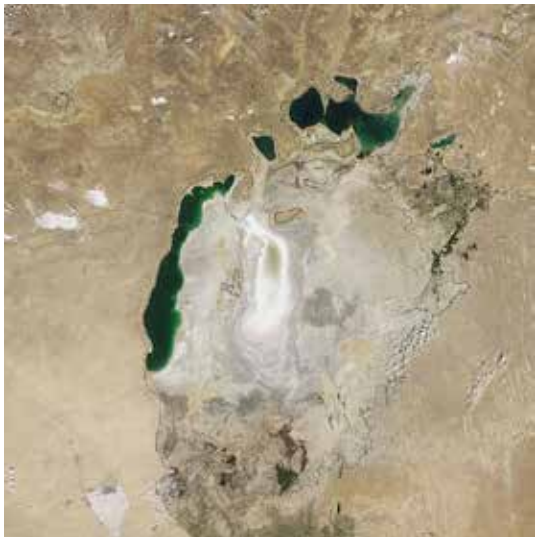
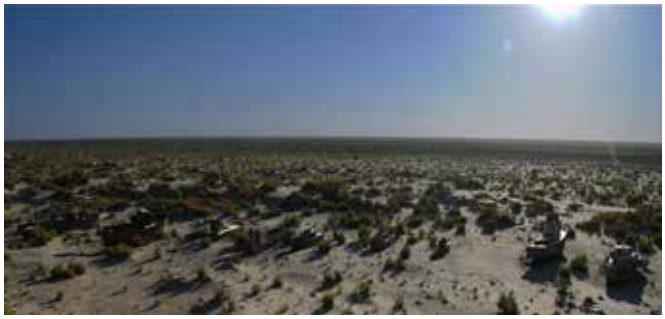
Measuring 300 km across, the Aral Sea was this size in 20th century until the 1960s



Now, the fragmented remainder of what was once the 4th world's largest inland water body

Classical river upstream-downstream connection. *Lower Amu Darya basin (field trip destination) and Northern Afghanistan (British Council project's focal area).*



Muynak town, Western Uzbekistan. *White sun, dunes, and fishing ships. The Aral Sea? Alas, welcome to Aralkum (Aral Sands), now a Karakum desert's brother! The Easter Island "in-the-desert" is gradually losing its civilization. Blending with the wasteland here, turning into a desert there, it may as well bounce back in some centuries. It happened before. There was a town with an irrigation network in the time of the Great Mongol Empire. It later ended up under the rising Aral Sea but is now once again fully exposed to the sun and wind. The history repeats itself, and these days it is Karakalpakstan's turn.*

British Council's DelPHE program (Developing Partnerships in Higher Education) brought the Asian Institute of Technology, Thailand, to partner with the Balkh University, Afghanistan, on water and other environmental issues of Central Asia. Notoriety of the Aral story is in its sheer and unprecedented size but ancient history abounds in cases of large-scale development degrading natural ecosystems. We made mistakes time and time again when our activities have been dramatically changing whole landscapes on all continents. Take the demise of great civilization in Mesopotamia (Babylon, Ur), when very specific Nile irrigation practices of old were thoughtlessly transferred from the Ancient Egypt and slowly, over centuries, lead to desertification of fertile lands between Tigres and Euphrates.

On the exact opposite side of the globe, in the Pacific Ocean, a mysterious Easter Island has another spectacular story to tell of its resources grossly overused and of a subsequent demise of civilization. It also started with humble human development and eventually went out of balance with nature. Then invading alien species, particularly rats, brought in by this very development, have dealt a decisive blow to the already ailing civilization. Famous giant stone heads serve as reminders of the days of former glory.

Another case is the transboundary Dead Sea in the Middle East. The story of its recent drying is in the same vein - fresh water diversion for human needs offsets a millennia-old hydraulic balance. Remainder of the Aral Sea steers towards another "dead sea" scenario, with its salinity still threefold lower, but increasing by every year and sure to reach saturation in the near future. Yet another dead sea on the record and conscience of humanity.

SEA is impossible without accounting for cumulative impacts (effects) of human development on the environment. Excessive use of water, pollution, erosion and numerous other anthropogenic impacts are frequently synergizing and cause substantial negative integrated impacts, which lead to environmental disasters, immediate (landslides, sandstorms, and health problems) or slow developing (desertification and droughts). Furthermore, climate change significantly increasing annual melting rate of glaciers in Central and North East Afghanistan further exacerbates environmental stress and imparts urgency to strategic measures of adaptation to future water use prospects.

The DelPHE project deals with the impacts through the development of the Cumulative Effects Assessment (CEA). CEA for the Amu Darya as a whole, and specifically for its Afghan Basin is long overdue. Balancing the use of water resources in between energy and agriculture is one of the aspects. Salinization, over-fertilization, and accumulated pesticides in the top soil are cumulative impacts which are known to inflict dramatically enhanced blows to the local population and ecology.

To really come up with a rationale for sustainability for Afghanistan and, in a broader sense, for the region of Central Asia, it makes sense to take a wider, global view of our environmental errors and lessons learned. It was worthwhile to get up close and personal with the way US authorities learn their lessons to provide for the future of the Colorado River Basin. Most of their moves are surprisingly relevant to Afghanistan.

Recent DelPHE project discussions with the universities and water authorities in the Colorado River Basin was yet another quest for solutions to the Afghan environmental conundrum. All arid regions are alike to a great extent, even in such countries of different history and socio-economics as the United States and Afghanistan. The Colorado River Basin story, is

Dried Aral seabed near Muynak, Western Uzbekistan. *Cruelly spectacular victim of human drive to dominate the environment, formidable fishing fleet is stalled forever in the waves of sand or gone to scrap metal. Ultimate masters of the desert, hardy saxaul trees, take over, both naturally and with a welcome German and French assistance.*

as glamorous as Las Vegas and Los Angeles sitting on its water, and nearly as ecologically sad as the Aral Sea's less publicized predicament. It offers surprising insights into relationships of man and water cruelly mediated by human development, kind of a Tale of Two Cities and only One River.

Colorado River provides for 30 million people, and still fast growing, but at the expense of the natural balance, which is negative for many decades. The river lost two thirds of its might and most of its ecological integrity, and ultimately ceased to normally flow into the Gulf of California for over half a century. Being the most important source of water in the South West, encompassing Arizona, California, Colorado, and Nevada, it supports 16,000 km2 of irrigation, and 4.2 GW hydropower infrastructures. The river also critically caters to 15 tribes of Native Americans, 12 national wildlife refuges and parks, and 4 recreation areas. Imbalances in water supply and demand, which already occur in the basin, are projected to increase further in view of climate change and further uncontrolled development. To an extent, these challenges are met by the capacity of numerous artificial river reservoirs to store about four times the average inflow.

Thinking about downstream while engaging in upstream activities is obvious. Thinking about the intertwined past and future of Amu Darya and Colorado River is a quantum leap forward. Tamarisk bush is just one common denominator. An aggressive invader, also known as salt cedar, is an ironical "present" to Colorado from Amu Darya. It is naturally abundant along the banks of Amu Darya and on the dried Aral Sea bed. Introduced to stop erosion it worked marvelously, until environmentalists realized that it stifles the Colorado River and wreaks havoc in its ecology.

The Colorado River Basin (CRB) Water Supply and Demand Study, equivalent to SEA, is currently being carried out in which all stakeholders take part. These are environmental organizations, native tribes and communities, hydropower and recreational authorities, and other Federal agencies. The main objectives are to assess future water supplies and demands up to 2060 and to evaluate the reliability of the Colorado River system to meet the needs of Basin resources, such as hydroelectric power generation; recreation; fish, wildlife, and their habitats; water quality; and flood control. Ultimately this is being done with a view of developing adaptation and mitigation strategies to address future water supply and demand imbalances.

The CRB Study anticipates that the likely options to address future water supply and demand imbalances will include (i) increased supply through importation, desalination, reuse, local supply, and watershed management; (ii) reduced demand via municipal and industrial conservation, agricultural water conservation, increase use of efficiency in the energy sector, and system storage reoperation for

Lower Amu Darya basin, Karakalpakstan, Western Uzbekistan. *Where Amu Darya ends, a debate starts. Mr. Mohammad Qaasim and Dr. Habibullah Habib Chancellor of Kabul University, Afghanistan discuss how we all are interconnected: Afghans (upstream) and Karakalpaks (downstream) of the Aral Sea. The role which educational and research organizations, such as universities, play in the complicated strategic environmental planning and management is critical since universities combine functions of both impact prediction and capacity building. The DelPHE project strengthens capacity for SEA in Afghanistan and facilitates activities of the government and NGOs.*

Grand Canyon, Arizona, United States. *A squirrel's immediate concern is what is happening here on the Colorado plateau, and whether it is ecologically comfortable at these heights. What is down there, at the Colorado River's level, is another affair, a much tougher story. One can barely discern in the gorge's depth a tight green belt of Asia's "present", tamarisk bush invading riverbanks increasing soil salinity, flooding, and fire frequency. On top of it, there are several major dams upstream and downstream, completely new, non-indigenous fish population, and intensive water abstraction for irrigation changing hydraulic regime. These are a few of the present concerns and some cumulative effects.*

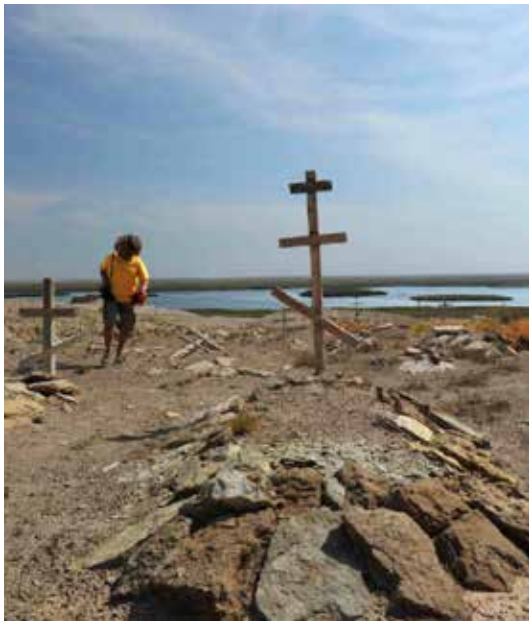
Gleaning environmental lessons and water-related experience to help the Afghan environment. The humbled Colorado river, now just a shadow of its former glorious past, was known through its murky abrasive power to chisel off granite of the plateau, creating an awesome canyon over a million years. And all those eerie features in the mist: Cheops pyramid, Krishna shrine, Solomon temple, and Zoroaster's canyon. All arid regions are alike to a great extent, even the United States and Afghanistan, countries with very different history and socio-economics. Historical formula is sadly straightforward: an uneven distribution of water resources overlaid on fragile ecosystems multiplied by human activities out of touch with natural balance, eventually reduced to a common denominator of ecological degradation. Major environmental sore of the Salton Sea in the lower basin is just one example.

reduced evaporation; (iii) operations modification including groundwater storage, hydropower optimization, basin-wide water banking, and market driven water transfers and exchanges; and (iv) governance interventions such as control of development growth, funding of basin-wide programs, enhanced data and information sharing, tribal water use and transfers, resolution of water claims, reallocation of state apportionments, etc. Given that environmental awareness and recognition of water related problems exist across Afghanistan, it is believed that none of these interventions are impossible even in their simplest and more cost-effective versions if only the necessary policy and institutional preconditions are met.

The DelPHE project uses mobile devices and Google maps to track recent environmental, landscape, and land use changes in its capacity building effort to boost environmental management in Afghanistan. The 21st century tool used by AIT and BU students is powerful enough under the field conditions, to discern tamarisk blooming along one of the remaining Aral delta wetlands.

The comparison between two rivers is striking not only from the ecological point of view. Situated at same latitudes with similar climates, the Colorado River and the three-fold greater in flow Amu Darya support roughly equal populations.

Las Vegas, Nevada, is a glorious oasis in the desert sea. *McDonald's leads the way reminding us that human survival or prosperity in the South West is contingent on such seemingly humble initiatives as saying good bye to a quintessential American lawn and embracing more locally appropriate vegetation landscapes fed by more economical drip irrigation.*



Urga, an abandoned fishing village on the Aral Sea reminds us to heed lessons of the past while looking forward to the sustainable future. People left the place decades ago: no fish – no jobs. Then, later, freshwater came back as Sudoche Lake through the efforts of the International Fund for Saving the Aral Sea (IFAS).

Mazar-e-Sharif, Northern Afghanistan. *Dredging a mirhab irrigation canal on Balkh River near Mazar-e-Sharif in Northern Afghanistan. Such systems, primitive they may seem, are still instrumental in feeding the country. Balkh River and Kholm River ceased to flow into Amu Darya centuries ago, extensive irrigation may have seriously contributed. The DelPHE project strives to turn the mirhab networking into a broader environmental stewardship system, not just water management as it always was.*

Further Reading:

H. Habib, A.J. Anceno, J. Fiddes, J. Beekma, M. Ilyuschenko, V. Nitivattananon, O.V. Shipin (2013) Jumpstarting strategic water resources protection from a changing global perspective: gaps and prospects in Afghanistan. Journal of Environmental Management, 129, pp. 244-259.

Kholm, Northern Afghanistan. *The area covered by the DelPHE project and situated at the extreme opposite end of the Amu Darya basin, in the upstream foothills of Hindu Kush Mountains, these famous pomegranate gardens in the town of Tashkurgan in the North of Afghanistan, are in grave danger due to the very same cumulative impacts as tugai forests of the downstream. Home of magnificent ruins of the glorious past, they now face new challenges of the post-conflict Afghanistan, ironically due to the good news for the upstream river area where recent agricultural boom led to renewed and intensified water abstraction for irrigation, the practice which was discontinued for many decades of conflict. For the last centuries the river was not in a possession of enough water to reach its natural destination, Amu Darya. Arguably, as observations all over the world show, it happened gradually, at least partially, due to a historically protracted period of substantial water abstraction in its basin. One can see the irrigation canals creating an artificial "delta" making up traditional Mirhab system, a backbone of Afghan agriculture for centuries.*

Dr. Habibullah Habib (former Chancellor of Balkh University, presently the Chancellor of Kabul University) explains that there is an interdependence of Amu Darya Basin ecosystems, e.g. this degraded pistachio forest and river floods. Capacity building is required to step up environmental education and management in Afghanistan and the DelPHE project does its bit through BU and AIT, while involving National Environmental Protection Agency of N. Afghanistan.

At times plainly dangerous, Amu Darya that night playfully swallowed up half of the house of this Turcoman in one of annual spring floods in the N. Afghan river basin. Strategic Environmental Assessment would surely help preventing such regular occurrences plaguing mainly Afghan side which in contrast to Tajik or Uzbek side is not only much lower, but also less environmentally fortified.

Bangkok, Thailand. *Turning once-a-century disaster into an opportunity of a life time, project participants at AIT continued environmental work even during the stupendous October-December 2011 flood in Thailand. Asian Institute of Technology, the DelPHE project lead, being at the epicenter of disaster was under up to 3 m of water for over 2 months. Nature on rampage did not deter the team from learning about disaster management in the framework of SEA. Learning professional skills of disaster management from real life, Afghan students came back to the flooded AIT campus to come to terms with the cruel reality. The Flood itself was a result of cumulative environmental impacts and the lack of a comprehensive SEA in the local river basin in the Central plains of Thailand. Positive side of such unfortunate events is that they bring new ideas on how to prevent or handle impacts in an environmentally sustainable way while demonstrating disaster resilience, capacity to adapt and continue operation.*

Performance-based Design: An Approach towards Safer, Reliable Structures

By Naveed Anwar

Trends show the number of buildings and building height to be increasing, increasing the need for more skilled engineers, equipped with better tools to evaluate and guarantee the safety and performance of such buildings.

Performance-based Design: An Approach towards Safer, Reliable Structures

On Building Safety

Asia's recent dominance of the tall-building industry is evident from the 2014 annual report of the Council on Tall Buildings and Urban Habitat (CTBUH), accounting 74 of the 97 tall buildings completed in 2014, or 76%, were in Asia. Trends show the number of buildings and building height to be increasing, increasing the need for more skilled engineers, equipped with better tools to evaluate and guarantee the safety and performance of such buildings.

Undeniably, as the tall buildings and complex structures are becoming more prevalent in our world today, the concern for the safety of the public from various natural and man made hazards is becoming more relevant. So when clients and users of the buildings ask a structural engineer, an apparently simple question "Is my structure safe?", engineers are at odds to respond to this explicitly. Generally, the structural engineers follow the prescriptive provisions of the building and design codes, and probably the best answer they could offer is that "I am not sure, but I have designed this structure according the building code!" Obviously, such a response may not be sufficient, or acceptable, but unless clearer and more refined design approaches and methodologies are used, this may be the only choice. The main reasons why an explicit answer is not possible, are, first, the question itself is not well-defined. It does not explain what a "safe design" is; and if it is safe against what effects, and what level of safety is required. It also does not allow the designer to carry out a clear-cut understanding and evaluation of the "strength" of the structure that is not bound by typical simplifications, arbitrary factors, and prescriptive limits.

The development and recent advancements in the Performance-based Design approach (PBD) provides an alternative, as well a progression to more explicit evaluation of the safety and reliability of structures for various hazards, specially earthquakes, and progressive collapse scenarios. PBD gives the opportunity to clearly define the levels of hazards to be designed against, with the corresponding performance to be achieved, and evaluate the cost implications in the process. This essentially allows the clients, building owners, and team carrying out the PBD to evaluate the explicit risks at the site, consider the purpose and usage of the building, and set the design for appropriate performance levels, in line with international guidelines and practices.

Intent and Justification for PBD

The Los Angeles Tall Buildings Structural Design Council (LATBSDC) provides several reasons justifying why PBD is a valid, and preferable option, compared to the traditional code based design, both for tall buildings and other structures:

- Code provisions are intended to provide a minimum level of safety for engineered buildings. The code prescriptive provisions are intended to provide safe design criteria for all types of buildings, ranging from small one and two-story dwellings to the tallest structures. As a result of this broad intended applicability, the provisions contain many requirements that are not specifically applicable to tall buildings and which may result in designs that are less than optimal, both from a cost and safety perspective.

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PBD guarantees

1. *Safer buildings with better performance*
2. *Verification of the performance of the building*
3. *More cost-effective buildings*
4. *Performance matching depending on requirements of the building*

- Almost all design codes have traditionally permitted the use of alternative analysis and design methods which can be justified based on well-established principles of mechanics and/or supported by convincing laboratory test results. For example, section 104.11 of 2012 edition of International Building Code (2012 IBC) and the same section in the 2013 California Building Code (2013 CBC) permit the application of alternative lateral-force procedures using rational analysis based on well-established but complex principles of mechanics in lieu of prescriptive code provisions.

GUIDELINES FOR IMPLEMENTING PBD

1. American Society of Civil Engineers (2013) ASCE Standard. Seismic Evaluation of Existing Buildings. ASCE/SEI 41-13. Virginia, United States.

2. Applied Technology Council, Pacific Earthquake Engineering Research Center (2010) Modeling and acceptance criteria for seismic design and analysis of tall buildings. PEER/ATC 72-1. Redwood City, California, United States.

3. Council on Tall Buildings and Urban Habitat (2008) Recommendations for the Seismic Design of High-rise Buildings - A Consensus Document - CTBUH Seismic Working Group. Chicago, Illinois, United States.

4. Applied Technology Council (ATC-33 Project) (1997) NEHRP Guidelines for the Seismic Rehabilitation of Buildings - Issued by Federal Emergency Management Agency (FEMA) in furtherance of the Decade for Natural Disaster Reduction. FEMA 273 and 274. Washington, D.C., United States.

5. Los Angeles Tall Buildings Structural Design Council (2014) An Alternative Procedure for Seismic Analysis and Design of Tall Buildings Located in the Los Angeles Region – A Consensus Document. Los Angeles, California, United States.

6. Pacific Earthquake Engineering Research Center (PEER) (2010) Guidelines for Performance-Based Seismic Design of Tall Buildings. University of California, Berkeley, California, United States.

LATBSDC also lists several guidelines that offer a number of advantages for opting for PBD when carrying out seismic design of buildings:

- More reliable attainment of intended seismic performance
- Reduced construction cost
- Elimination of some code prescriptive design requirements
- Accommodation of architectural features that may not otherwise be attainable
- Use of innovative structural systems and materials

Design Team Qualifications

The appropriate implementation of PBD process requires an in-depth understanding of ground-shaking hazards, structural materials behavior, and nonlinear dynamic structural response, specifically knowledge of:

- seismic hazard analysis and selection and scaling of ground motions
- nonlinear dynamic behavior of structures and foundation systems including construction of mathematical models capable of reliable prediction of such behavior with understanding and skills in the use of appropriate software tools
- understanding of capacity design principles and detailing of elements to resist cyclic inelastic demands, and assessment of element strength, deformation, and deterioration of characteristics under cyclic inelastic loading

These knowledge and skill sets are generally not imparted to structural engineers in a typical undergraduate civil engineering program. These are either acquired through a specialized master's degree programs, or through extensive training and experience in PBD applications under the supervision of experts. Also, it is uncommon that a single person can possess all these abilities, thus performing PBD requires a specialized team of engineers to carry out the process. To increase reliability, the use of the PDB approach on a project often requires that a third party, also specialized in PBD, carry out a review of the procedures to be followed, hazard and performance criteria that are set to be used, and the final outcome.

The willingness of building developers and clients to engage primary structural engineers, PBD specialists and reviewers clearly indicate that the advantages of using PBD are becoming evident both in terms of enhanced performance and public safety and better cost-effectiveness.

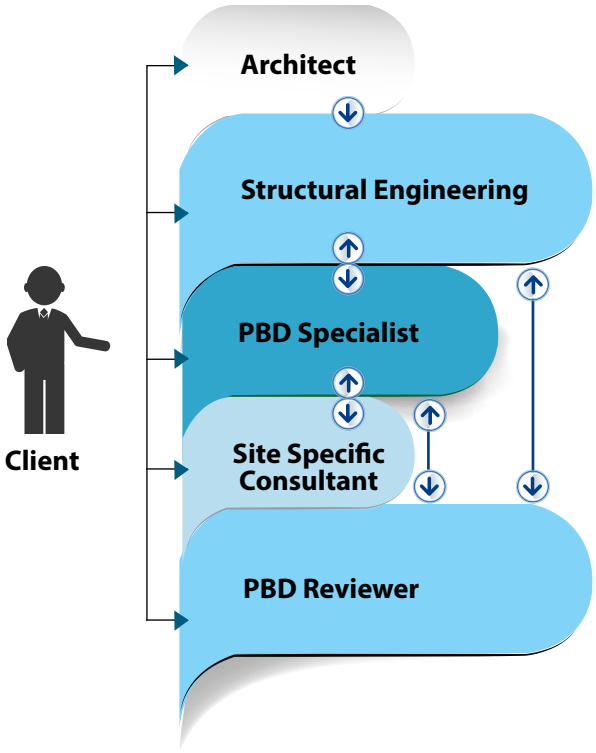
As shown in the figure, in a typical scenario, the client, architect, structural engineers using code-based design, specialized PBD consultants, and PBD peer reviewers jointly work to enhance the performance and reliability of the structure, while maintaining cost effectiveness.

AIT's Role in Development and Application of PBD

The Asian Institute of Technology (AIT) has all of the ingredients to develop and apply PBD approaches. First, AIT's master and doctoral academic programs in structural engineering have traditionally focused on computational mechanics, development of finite element methods, and software tools and their application, a necessary ingredient of the advanced analysis and simulations needed for PBD. When combined with extensive courses and research capability in structural dynamics, earthquake and wind engineering, advanced concrete technology and mechanics, learning tall building design provides a complete knowledge and skill set to students needed to undertake both research and application of advanced analysis and design, an essential part of PBD. More than half of the master and doctoral thesis research in the past decade were conducted, both experimentally and computationally, on various aspects leading to greater understanding and development of the procedures and methodologies for advanced design procedures, including PBD.

With the recent establishment of AIT Consulting (AITC), the practical application of these capabilities and applications to real-life, large projects has added another dimension, which in addition to providing PBD related expertise and services to the industry, feeds back to the academic programs, and research. These capabilities and involvement are highlighted by deep regional experience in Asia. To date, 67 tall buildings in Asia were evaluated by using the PBD approach, many of which were further reviewed by third-party experts based in the United States. This advanced and highly specialized work is carried out by AITC team of adept structural engineers, advised by the AIT faculty experts, such as the Prof. Pennung Warnitchai.

AIT Consulting, together with Asian Center for Engineering Computations and Software (ACECOMS), also based at AIT, and its close partners such as Computers and Structures Inc., (CSI), United States, the developers of the primary software used for PBD, have conducted several regional events, highlighting the developmemts and advantages of using PBD. Recently the president of CSI, Mr. Ashraf Habibullah, visited Bangkok and Manila to speak in such events.



Performance-based Design Team and Process

AIT, through its acedemic programs, various centers and partners, is committed to lead the development and application of new technologies to provide safer and more reliable structures for the safety of the buildings, infrastructure and most importantly, people.

With contributions from Thaung Htut Aung, Deputy Director, AIT Consulting.

67 Tall Buildings | **PBD** Performance-based Design

Tall Buildings and PBD at AIT Consulting

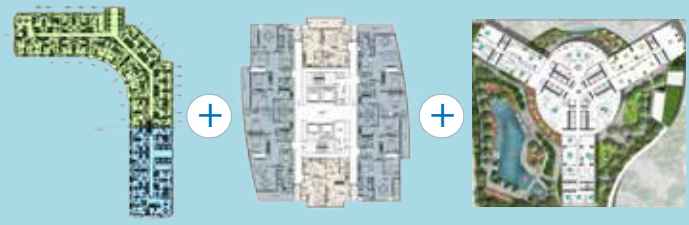
HEIGHT

12,000
Combined height of buildings evaluated

>

8,848 m
Mt. Everest

Floor AREA



5 km²
Combined floor area of buildings evaluated

>

Monaco + Male + Vatican

WEIGHT

5,850,000 tons
Combined weight of buildings evaluated

>

USS Gerald Ford
Supercarrier

In Focus: Selected Projects

The Sandstone at Portico

Site-Specific Probabilistic Seismic Hazard Assessment and Performance-based Evaluation

Client	Sy^2 + Associates Inc.
Location	Philippines

Site-Specific Probabilistic Seismic Hazard Assessment

Probabilistic Seismic Hazard Assessment (PSHA) is an effective method of integrating all possible earthquake occurrences and ground motions to calculate a combined probability of exceedance that incorporates the relative frequencies of the occurrences of different earthquakes and ground-motion characteristics.

It is globally known that natural disasters including earthquakes have been increasing significantly over the past decade, impacting mankind with relentless frequency and intensity. For this reason, it is of utmost importance to identify and to consider the time, location, and intensity of such a natural disaster occurrence. Together with initiatives for awareness, it would be imperative to prepare for such events in advance in order to prevent massive damage and ensure public safety. Urban regions, especially mega cities with high-rise buildings, are especially vulnerable to such damaging earthquake ground motions, and events thereafter.

Manila, being a mega city with its vast amount of high-rise buildings, is just as much at risk to such natural disasters, which could have the potential of causing enormous amounts of damage. However, with seismic hazards thus determined, their risks can be assessed and included in such areas as building codes for standard buildings, designing larger buildings and infrastructure projects.

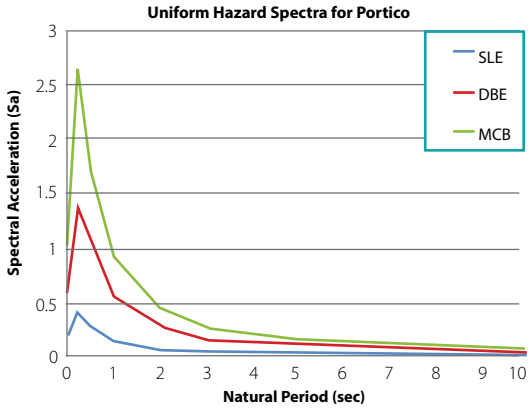
This project was awarded to AIT Consulting by SY^2 + Associates, Inc. in order to perform site-specific PSHA for one of Manila's premiere real-estate projects, Portico. In order to understand the seismic hazard at the project site, which is located in Pasig City, the locations: 14.574214ºN and 121.065415ºE were used.

The study was comprised of the following activities: probabilistic seismic hazard analysis, deaggregation analysis, ground motion selection and scaling, ground investigation by using array microtremor observation, and ground response analysis by using equivalent linear analysis method to compute soil amplification effect at the selected site.

The ground motion parameters, such as peak ground acceleration (PGA) and spectral acceleration (SA) were estimated from the earthquake magnitude, source-to-site distance, and the local site condition determined by appropriate ground motion prediction equations (GMPEs). The hazard at the study area was evaluated by considering the effects of all earthquakes of different magnitudes, occurring at different locations in different seismic sources and at different probabilities of occurrence.

The PSHA results of Portico were presented in terms of Uniform Hazard Spectrum (UHS) at return periods of 43 (Service Level Earthquake - SLE), 475 (Design Basis Earthquake - DBE), and 2475 (Maximum Considered Earthquake - MCE) years. The contribution of different earthquake source models to the total hazard was examined and displayed in disaggregated seismic hazard maps at building natural periods. UHS at 43-, 475-, 2475-year return periods and Conditional Mean Spectra (CMS) at 2475-year return period for the Portico site with suites of scaling spectrum strong ground motion were also developed to be used for nonlinear response history analysis of high-rise buildings under various shaking levels.

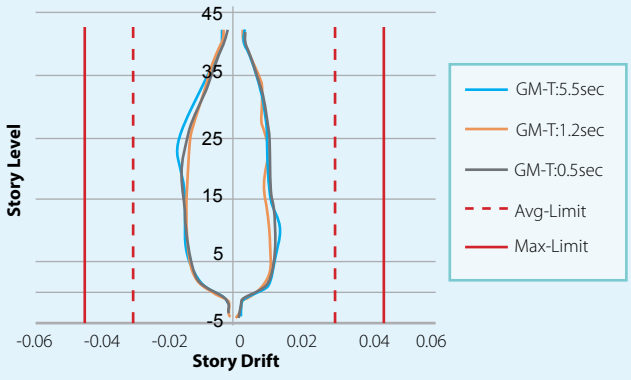
Sample results are presented below strictly for knowledge sharing among peers.



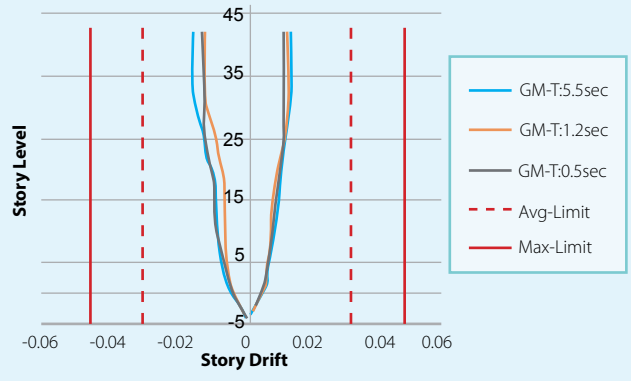
The uniform hazard spectra for Portico site at 43-, 475-, and 2475-year return periods at bedrock (Soil type Sb)

Performance-based Evaluation

Sample results on the peak transient drifts checked under MCE level earthquakes are presented below. The maximum value of the mean values from each set of ground motions were checked against the limit of 0.03. The maximum story drift ratio from any ground motion was checked against the limit of 0.045. Residual drifts were also checked to protect against excessive post-earthquake deformations. The maximum value of mean values from each set of ground motions were checked against the limit of 0.01. The maximum residual drift ratio from any ground motion was checked against the limit of 0.015. It was found that both transient drift and residual drift ratios were generally within the acceptable limits.

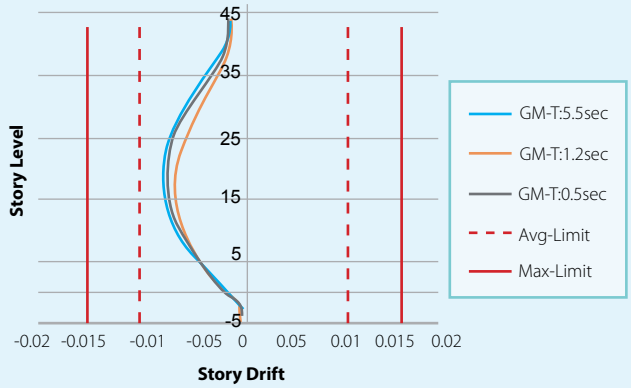


(a)

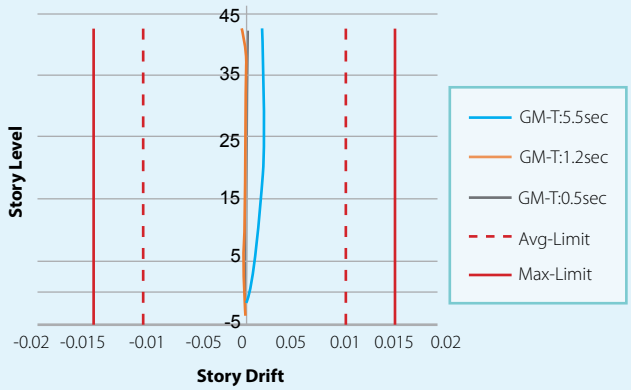


(b)

Figure 1-2: *Transient Drift: (a) X-direction, (b) Y-direction at MCE Level*



(a)



(b)

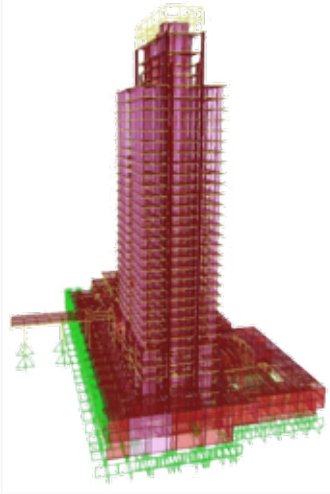
Residual Drift: (a) X-direction, (b) Y-direction at MCE Level

A full report specifying the results of the PSHA and PBE, analysis, and recommendations were provided to the client.

Ireo City Hotel and Office

Performance-based Evaluation and Progressive Collapse Assessment

Client	Ireo Hospitality Company Pvt. Ltd.
Location	Gurgaon, India



Ireo Hospitality Company Pvt. Ltd. engaged the services of AIT Consulting at Asian Institute of Technology (AIT), Thailand, to carry out the performance-based evaluation (PBE) and progressive collapse assessment of Ireo City two towers, one of which houses the hotel, a 34-story building, while the office will be operated as an office tower, a 32-story building. The two buildings are reinforced concrete structures supported by a raft foundation. Both towers rest on a 3-level basements.

Based on the analysis results, the performance of the building was assessed by using several response indicators such as natural periods, mode shapes, base shear, story drifts, lateral displacements, deformation capacity, and strength capacity of the primary components were checked.

The AITC team determined that the structure would remain in elastic range under the MCE level and that the structural components will be able to resist the demand forces at this level of earthquake. A complete report detailing the PBE results, analysis, and recommendations were provided to the client outlining recommended revisions. Progressive collapse assessment is ongoing.

Garden Towers

Performance-based Evaluation

Client	Ayala Land Premier through Sy^2 + Associates, Inc.
Location	Manila, Philippines

Garden Towers is a prime residential enclave that will rise in the newly master-planned Ayala Center redevelopment. Located in Ayala Center, Makati City, Garden Towers consist of two high-rise residential towers. The residential tower 1, which is approximately 51-story high-rise building (about 170-meters from ground level to lower roof deck level) and 4 stories of below grade parking (extending approximately 14-meters below grade). The typical floor plan is a hexagonal-shaped plan. The tower consists mainly of residential units, and a terrace and amenity deck. The ground level contains retail and back of the house space.

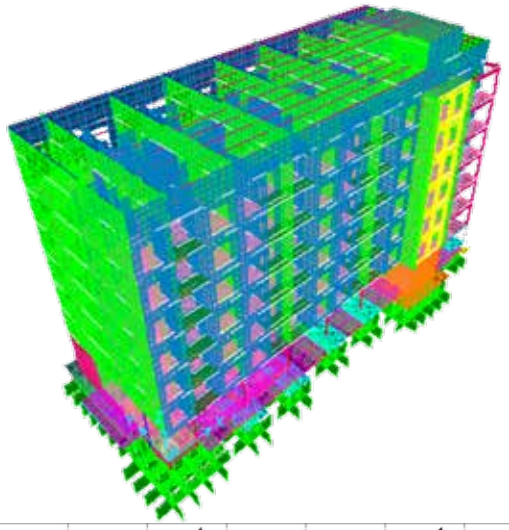
Partner Sy^2 + Associates, Inc. awarded the task of evaluating these towers for safety under seismic activity to AIT Consulting.

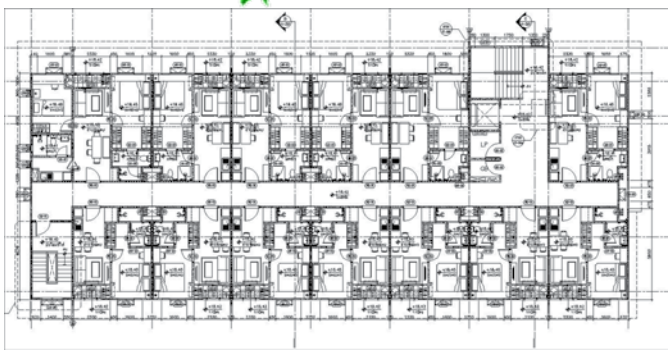
PBE was implemented using state-of-the-art analyses tools and procedures with a special emphasis on the effects of earthquakes. The performance of the building was evaluated at the MCE level (2475-year return period) and at Service Level (43-year return period) earthquakes. For the MCE level, nonlinear time history analysis was performed using seven appropriate ground motions. An average of seven ground motion records was used to determine the response of the building. To determine the building's performance for service level earthquake, a response spectrum analysis was conducted, using the service level response spectrum. Based on the analysis of the results, the performance of the building was assessed using several response indicators such as natural periods, mode shapes, base shear, story drifts, lateral displacements and deformations, and force capacities of the primary members.

Results and analysis were prepared in detail in a comprehensive report which was submitted to the client. All recommended adjustments, improvements, and redesigns were included in the report and provided to Sy^2 + Associates, Inc. to incorporate in the construction documents.

Pruksa's Precast Bearing Wall System

Seismic Performance Evaluation





Client	Pruksa Real Estate Public Company Limited
Location	Bangkok, Thailand

Pruksa Real Estate Public Company Limited engaged the services of AIT Consulting at the Asian Institute of Technology (AIT), Thailand, to carry out seismic performance evaluation of Pruksa's precast bearing wall system for an 8-story building located in Thailand.

The seismic performance evaluation of the pre-cast bearing wall system for an 8-story residential building was carried out through the use of state-of-the-art analyses tools and procedures with special emphasis on the effects due to earthquakes.

Three-dimensional finite element models were created with appropriate finite elements to represent the structure of the building. The frame and shell elements were used to represent the structural components. The connections between walls were simulated by nonlinear link elements using properties based on a previous study. Nonlinear static equivalent force analysis was performed to study the response of building under MCE level. The lateral load patterns at each story representing earthquake loads were calculated using the lateral load of each mode determined by modal separation based on response spectrum analysis results.

Based on the results of the seismic performance evaluation, it was confirmed that the overall response was within the acceptable limit. The forces in all main structural components and connections were found to be less than their capacities. A full report was submitted to the client containing the complete details of the evaluation, including recommendations.

Acqua Iguazu by yoo

Performance-based Evaluation

Client	Century Properties through Sy^2 + Associates, Inc.
Location	Manila, Philippines

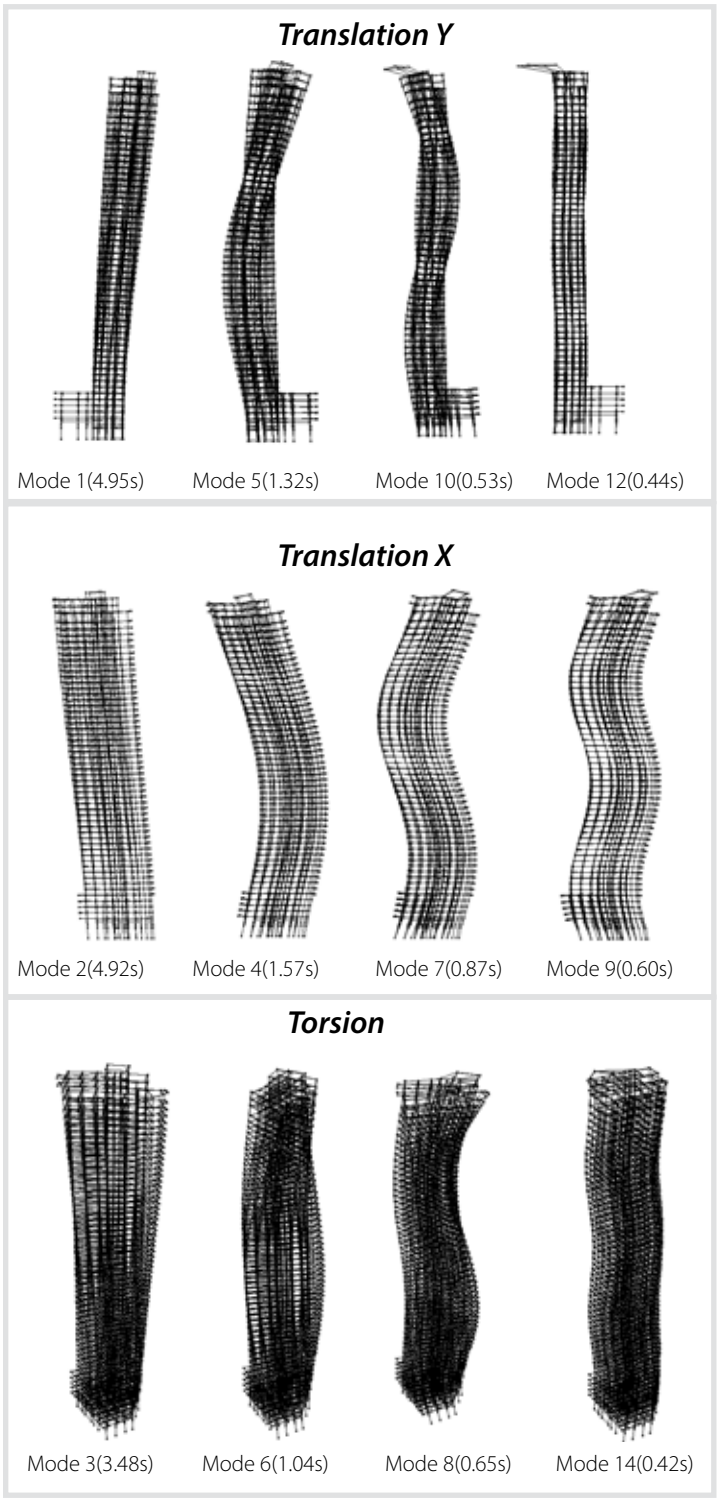
Acqua Iguazu by yoo is the fifth tower to rise in the Acqua Private Residences development, and will be interior-designed by the world's greatest design mind, Philippe Starck.

This building is part of the Acqua masterplan which devotes 70% of the entire property to open space, from rainforest-inspired landscaping, lagoon pools, waterfalls, walking trails, and pocket gardens across varying levels on all buildings and rooftops, complete with rock formations, treetop canopies, and ponds. Six towers preside, each named after some of the most beautiful waterfalls in the world, and are located in Mandaluyong City, Philippines.

Sy^2 + Associates, Inc. engaged the services of AIT Consulting, Asian Institute of Technology (AIT), Thailand, to continue carrying out the structural performance-based evaluation of the next tower from the Acqua masterplan. It is a 57-story high-rise residential tower, with a height of 187.5 m above the ground level. The building is a reinforced concrete building, supported by the pile foundation. The lateral force resisting system is a dual system, comprised of shear walls and a special moment resisting frame.

PBE was implemented using state-of-the-art analyses tools and procedures with a special emphasis on the effects of earthquakes. The performance of the building was evaluated at the Maximum Considered Earthquake level (2475-year return period) and at Service Level (43-year return period) earthquakes.

Based on the analysis of the results, the performance of the building was assessed using several response indicators such as natural periods, mode shapes, base shear, story drifts, lateral displacements and deformations, and force capacities of the primary members. Sample modal shapes are presented below strictly for knowledge sharing among peers.



Mode Shapes

The overall response of the building were determined to be serviceable under frequent earthquakes. Almost all members remain elastic under service level earthquakes. A full report was submitted to the client containing the complete details of the evaluation, including recommendations.

Regional Forum on Climate Change (RFCC)

Low Carbon and Climate Resilient Societies: Bridging Science, Practice, and Policy

1-3 July 2015
Asian Institute of Technology, Thailand

The Regional Forum on Climate Change (RFCC 2015) - Low Carbon and Climate Resilient Societies: Bridging Science, Practice, and Policy will be held on 1-3 July 2015 at the Asian Institute of Technology (AIT) to provide a channel of communication among the stakeholders in ASEAN countries that would influence climate policy in the region and inspire ASEAN position for climate change negotiations at the global scale.

RFCC 2015 will serve as a prelude for this year's **United Nations Conference on Climate Change (COP 21)** to be held in France that aims to finalize the new international climate agreement applicable to all countries after 2020. COP21 is the continuation of the Warsaw Conference (COP 19) for a broader framework of dialogue among the vast array of stakeholders: scientists, civil societies, governments, private sector, to lay the foundation for more meaningful global level talks between countries.

The two and a half day forum invites papers in both climate change mitigation and adaptation sectors. These papers shall present topics based on three broad categories: contemporary scientific research on climate change related topics (Category A); on-the-ground evidence (case studies) of climate change mitigation and adaptation endeavors (Category B); and current and proposed national (or regional and international) policy initiatives (Category C).

RFCC 2015 will also feature the following:

Science and Climate Change – Call for Proposals.
There will be a Call for Proposal at the end of the forum on topics linked to the thematic areas of the forum.

ASEAN Working Group on Climate Change (AWGCC).
The ASEAN policy makers and scientific advisers will meet in closed sessions to discuss their positions, concern, and prospects for COP 21.

ASEAN Scholars Program (ASP).
Selected scholars will be awarded a grant through an open call to visit AIT for months to develop a relevant position paper, detailing the science, practice, and policy implications in ASEAN in the context of climate change.

COP 21 Media Training.
Ten (one from each ASEAN member state) young professionals and civil society candidates from the media community will be selected to be trained to report on COP 21 and climate change during the forum.

Side Events and Exhibition Booths.
There are a number of side events during the forum that include exhibition booths hosted by leading national and international organizations to address the relevant climate change agenda in various setting.

Key Dates

Registration Open:	20 February 2015
Deadline for Receiving Abstracts:	31 March 2015
Notify Authors of Selection:	21 May 2015
Early Registration Deadline:	31 May 2015

For inquiries, please contact:
Mukand S. Babel
Chair, Organizing Committee, RFCC 2015
Asian Institute of Technology
Tel : +(662)-524 5790
E-mail : *rfcc2015@ait.asia*

Organizers:

Partners and Sponsors:

Full details of the conference can be found at their website:

Software Tools for Structural and Earthquake Engineering

Founded in 1975, Computers and Structures, Inc. (CSI) is recognized globally as the pioneering leader in software tools for structural and earthquake engineering. Software from CSI is used by thousands of engineering firms in over 160 countries for the design of major projects, including the Taipei 101 Tower in Taiwan, One World Trade Center in New York, the 2008 Olympics Birds Nest Stadium in Beijing and the cable-stayed Centenario Bridge over the Panama Canal.

CSI produces five primary software packages: SAP2000, CSiBridge; SAFE, PERFORM-3D, and ETABS. Each of these programs offers unique capabilities and tools that are tailored to different types of structures and problems, allowing users to find just the right solution for their work.

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Offers powerful parametric design of concrete and steel bridges.

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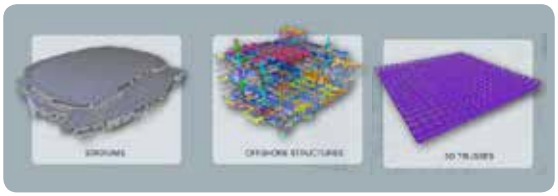
Intended for use on civil structures such as dams, communication towers, stadiums, industrial plants and buildings.



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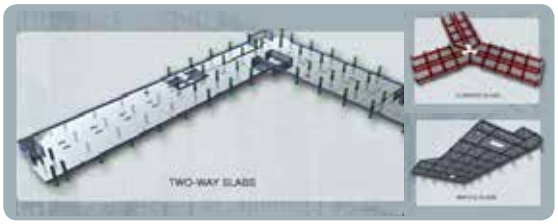

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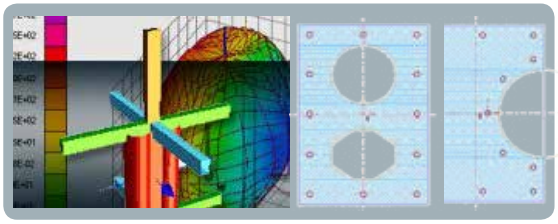

ACECOMS and AIT Consulting are providing support to CSI for development of design tools, particularly for the ETABS software package. These modules include section designer, wall designer, column designer, footings and steel connection. The developed ETABS modules will be used by engineers in building and structure design of multi-story commercial and residential structures.

For more information : ***www.csiamerica.com***

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