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Theme 2

Natural and Manmade Hazard Prevention and Management

WORKSHOP 2: MEETING CHALLENGES OF CLIMATE CHANGE AT THE LOCAL LEVEL THROUGH ICM

24 November 2009

United Nations Development Programme (UNDP) – Philippines

Chair: **Dr. Gunnar Kullenberg**
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UNDP – Philippines

The East Asian Seas Congress 2009

"Partnerships at Work: Local Implementation and Good Practices"

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Co-Convening Agency:
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INTRODUCTION

Climate change is a critical and cross-cutting issue, which can affect various aspects of sustainable development. There is a growing concern over its impacts and potential catastrophic consequences, particularly in East Asia, with its long coastlines, economic activity and population concentration in the coastal areas, and reliance on agriculture and use of natural resources for economic development. This workshop, which consisted of 16 presentations and open discussions, highlighted the diverse challenges posed by climate change to the region, particularly at the local level, the usefulness of the integrated coastal management (ICM) framework and process in dealing with such challenges, and the emerging approaches and needs for climate change adaptation for coastal and marine areas.

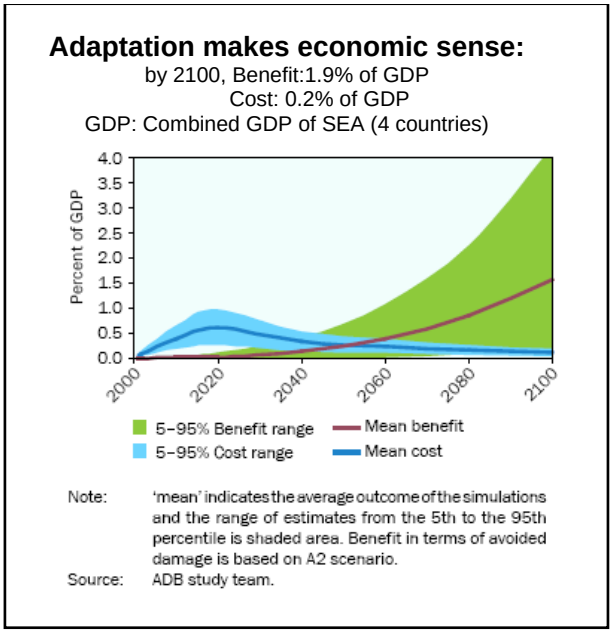
ICM has been recognized as a valuable tool in achieving the broader goals of sustainable development in various international agreements including the Plan of Implementation of the World Summit on Sustainable Development, the Agenda 21, the Convention on Biological Diversity, and the United Nations Framework Convention on Climate Change. In the Manado Ocean Declaration adopted by the World Ocean Conference in Manado, Indonesia in May 2009, ICM was affirmed as a valuable tool in achieving sustainable development and climate change adaptation. This workshop provided examples of ICM implementation at the local level that address various issues related to conservation and sustainable development of the marine and coastal areas including considerations of natural

hazards, climate variability, sea level rise, and erosion, among others. The workshop also highlighted how ICM provides a platform and process for developing institutional mechanisms that support interagency and multisectoral collaboration and facilitate strategic selection of issues and corresponding policy and management measures, including climate change adaptation. Examples of practical adaptation measures were also discussed, along with technical advancements and capacity-building needs for incorporating climate adaptation into existing ICM programs.

VULNERABILITY OF COASTAL AREAS AND MARINE ECOSYSTEMS IN EAST ASIA TO CLIMATE CHANGE

Economic modeling carried out under the Asian Development Bank (ADB) study entitled "The Economics of Climate Change in Southeast Asia: A Regional Review (2009)"[1] confirmed that Southeast Asia is more vulnerable to climate change than the world as a whole. Without further mitigation and adaptation, the four countries included in the study — Indonesia, Philippines, Thailand and Vietnam — were projected to suffer a mean loss of 2.2 percent of GDP by 2100 on an annual basis, if market impact (mainly agriculture and coastal zones) were considered. This is well above the world's 0.6 percent. The mean impact could be dramatically worse, equivalent to 5.7 percent of GDP each year by 2100, if non-market impacts (mainly related to health and ecosystems) were included and 6.7 percent if the chance of catastrophic events was also considered. Again, these are higher than the world's 2.2 percent and 2.6 percent losses, respectively.

Figure 1. Cost and Benefit of Adaptation.



The Southeast Asian region actually has made significant efforts in climate change adaptation, although these have been mostly reactive so far and still inadequate to cope with future challenges particularly more extreme events; hence the need to enhance adaptive capacity in the region. It is estimated that adaptation for the agriculture and coastal zones for the four countries would cost about US$ 5 billion per year on average but that benefits would exceed the cost by 2060. By 2100, the benefits could be 1.9 percent of GDP compared to the cost at 0.2 percent of the GDP. Adaptation, however, also needs to be complemented by mitigation efforts. Southeast Asia contributed 12 percent of the world's greenhouse gas emissions (GHG) in 2000, with 75 percent of emissions coming from the land use change and forestry sector, 15 percent from energy sector, and 8 percent from agriculture. Reducing emissions from deforestation and degradation, implementing win-win mitigation options in the energy sector, and exploring mitigation potential of the agriculture sector were recommended.

In the study entitled "Climate Change Vulnerability Mapping for Southeast Asia (2009)"[2], which covered 530 subnational areas in Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam, the Economy and Environment Program for Southeast Asia (EEPSEA)

showed that the hotspots or most vulnerable areas in Southeast Asia includes all the regions of the Philippines, the Mekong River Delta in Vietnam, almost all the regions of Cambodia, North and East Lao PDR, the Bangkok region of Thailand, and West Sumatra, South Sumatra, Western Java, and Eastern Java in Indonesia.

The assessment defined vulnerability as a function of exposure, sensitivity, and adaptive capacity. Exposure to five climate hazards, namely, tropical cyclones, floods, landslides, droughts, and sea level rise were measured; population density and extent of protected areas were used as proxies for human sensitivity and ecological sensitivity, respectively; and adaptive capacity was measured based on selected socioeconomic variables, technology, and infrastructure. Indices of vulnerability to climate change were then generated and illustrated through spatial maps, which enables the visualization of vulnerable areas, incorporation of the socioeconomic dimension in vulnerability assessment, and downscaling of vulnerability assessment to subnational levels. The information is expected to help target research and development efforts particularly at the local/subnational levels and most vulnerable areas, facilitate discussions on policy actions, and serve as a tool for decisionmaking, including resource allocation on climate change initiatives. To complement the mapping study, EEPSEA also conducted cross-country adaptation case studies in Vietnam, Thailand and the Philippines to determine the adaptive strategies of households, communities and local government units when confronted with extreme climate events.

Figure 2. GHG Emissions in Southeast Asia (2002).

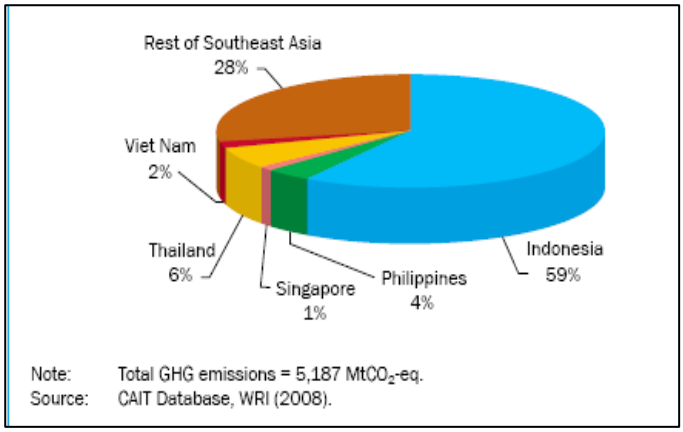
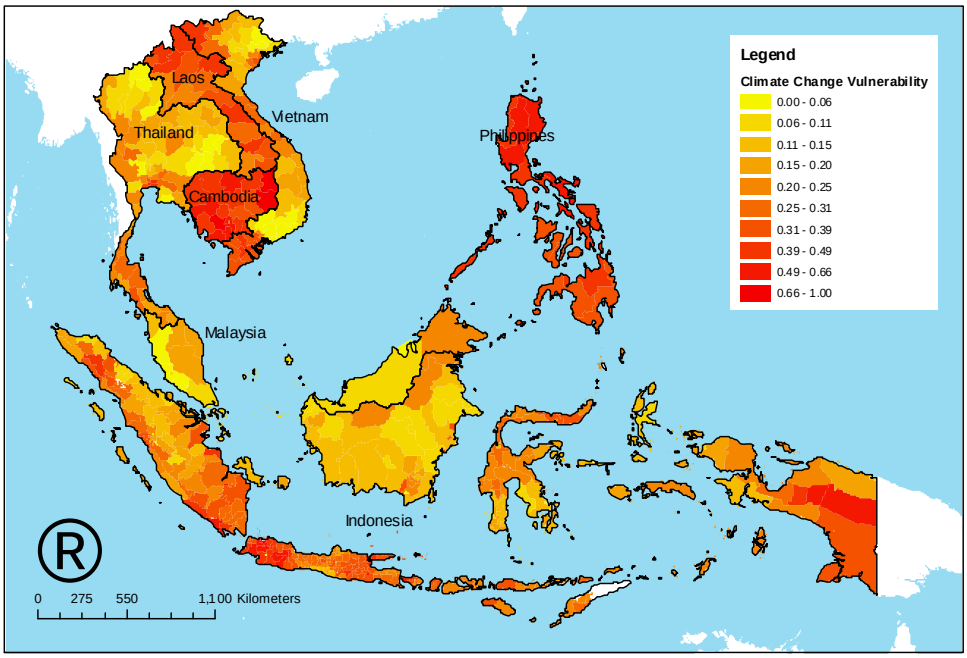


Figure 3. Climate Change Vulnerability in Southeast Asia.



CURRENT APPROACHES, STRATEGIES AND TOOLS FOR CLIMATE CHANGE ADAPTATION IN THE CONTEXT OF INTEGRATED COASTAL MANAGEMENT

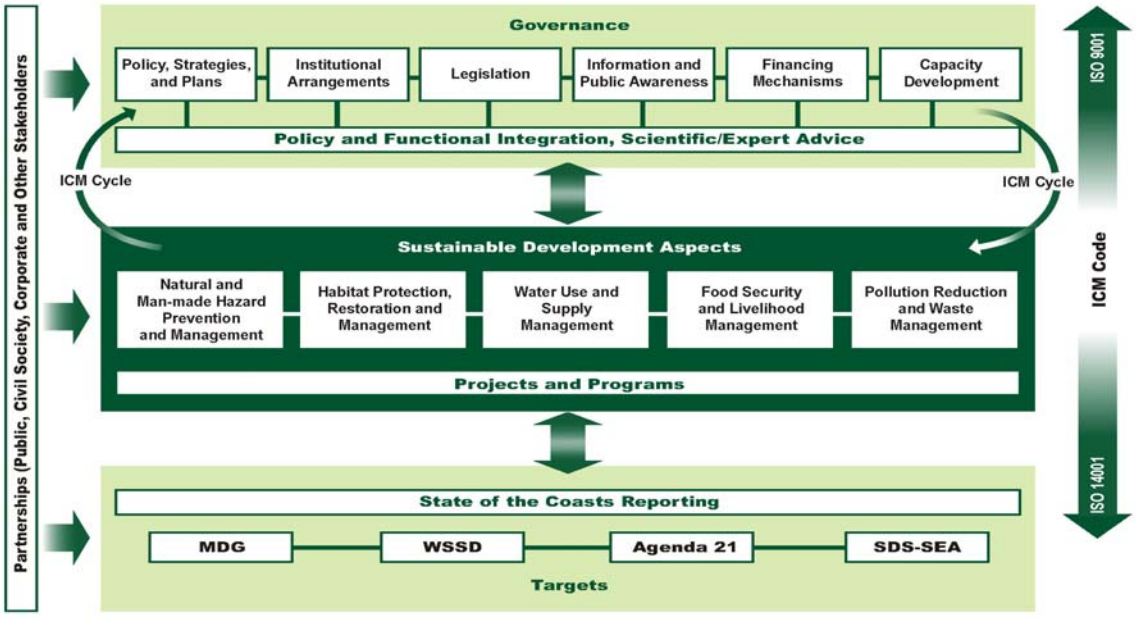
ICM can be a useful tool for addressing specific development challenges and optimizing climate change response at the local level[3]

ICM application for developing and managing marine and coastal areas and resources can advance parallel goals such as reducing poverty, increasing food security, fostering economic growth and protecting ecosystems. It can also more effectively tackle specific issues related to climate change, such as controlling flooding, mitigating the effects of storm surges and sea-level rise, strengthening disaster preparedness and response mechanisms, and improving the resiliency of communities and marine and coastal ecosystems.

Using an ecosystem-based management approach, ICM focuses on maintaining the integrity of ecosystems by managing human activities and their impacts on the ecosystem. ICM also promotes integration and coordination of policies and management actions of relevant sectors within the ICM program, policies and management reforms to facilitate policy and functional integration based on scientific advice, and various inter-sectoral activities. ICM also emphasizes readiness and flexibility to make appropriate management adaptations in response to changing ecological, political and socioeconomic conditions that may hamper the ICM initiative.

Through the development and implementation of an integrated approach to marine and coastal area and resource management under the PEMSEA Regional Programme, 28 local governments in 11 countries across the East Asian Seas region are progressing towards their sustainable development objectives and at the same time, addressing climate change adaptation. Building on the knowledge, skills and lessons from these local initiatives, efforts are underway in the countries to scale up ICM implementation in line with the target adopted by PEMSEA Country Partners through the Haikou Partnership Agreement to implement ICM programmes in at least 20 percent of the region's coastlines and adopt coastal policies in at least 70 percent of the countries by 2015.

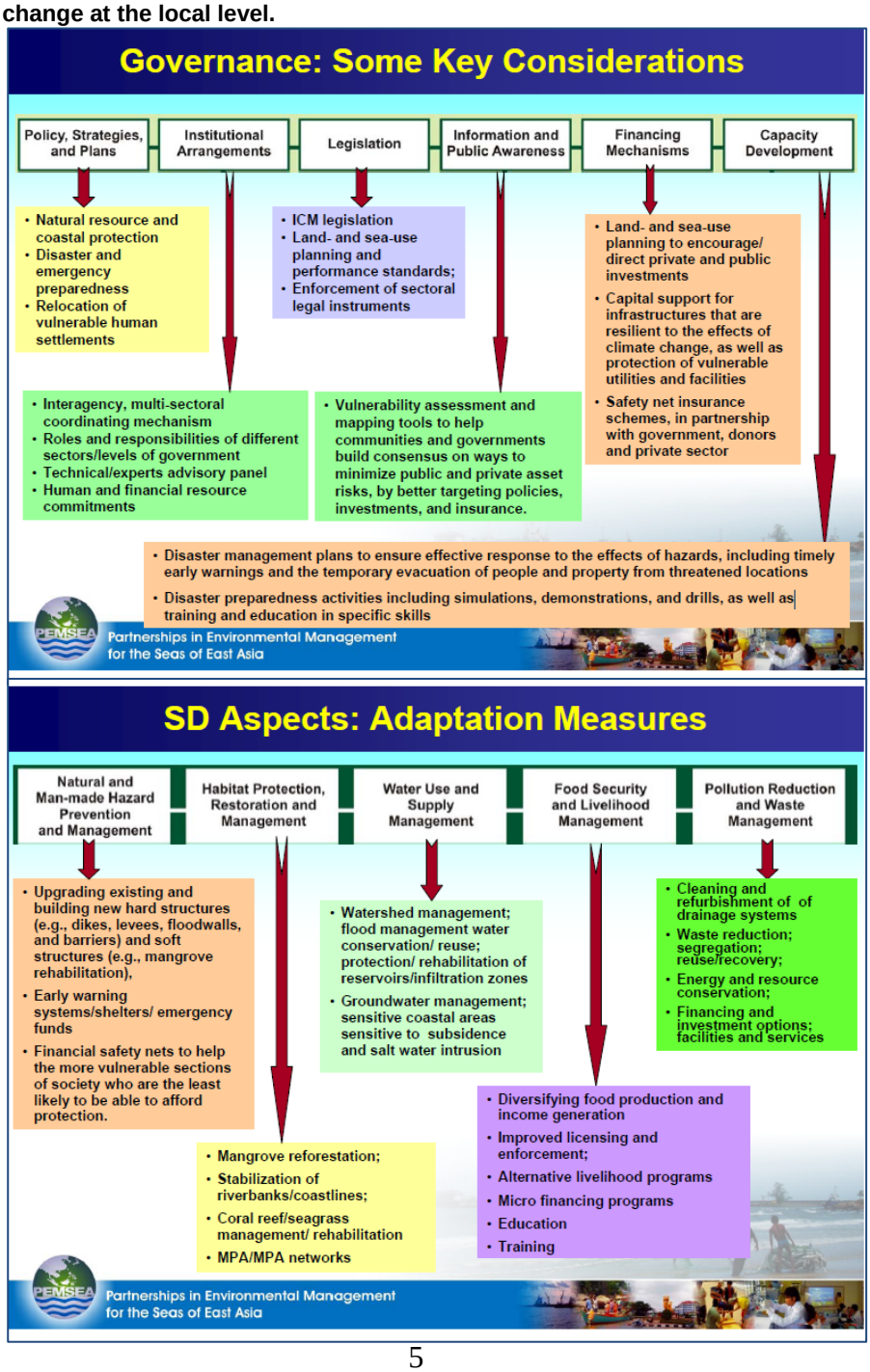
Figure 4. Framework for Sustainable Development of Coastal Areas through ICM Implementation.



The practical experience in the application of ICM in the East Asian region over the past 15 years has led to the development of a common framework for sustainable development of coastal areas, which covers a system of governance as well as several issue-specific management systems critical to achieving the overall goals of sustainable development, including climate change adaptation.

Climate change adaptation is one aspect of sustainable development, and not a separate issue. ICM can be utilized by local governments to optimize responses to climate change at the local level by reinforcing the planning and coordination of actions across and within sectors.

Figure 5. Examples of how ICM can be utilized by local governments to optimize responses to climate change at the local level.



Enhancing multi-sectoral coordination and stakeholder participation for sustainable development and climate change adaptation in Chonburi, Thailand[4]

In Chonburi Province, a major area for coastal tourism, industry, fisheries and port operations in Thailand, ICM implementation facilitated the development and adoption of a common framework for addressing priority threats to the sustainable development of the coastal area. This includes development and adoption of a common vision, strategies, action plans, multisectoral coordinating mechanism, and financing mechanism for marine and coastal management across 26 local governments, and various agencies and sectors. Stakeholder awareness, education and mobilization efforts have also provided opportunities for direct involvement of local people in on-the-ground actions, including waste management, sea turtle and crab protection and conservation, mangrove rehabilitation, seagrass transplantation, beach restoration and restoration, and local oil spill contingency plan development, among others. Collaborations and partnerships have also been established with central government agencies, private sector, academic institutions and technical experts, local, national and international nongovernmental organizations, and international donors for enhancing various aspects of their marine and coastal management. In recent years, issues such as excessive precipitation and flooding, drought and water shortage, coral bleaching, mass mortality of shellfish due to changes in salinity, and coastal erosion, among others, have raised concerns regarding possible linkages with climate change. In response, Chonburi is strengthening the implementation of the Chonburi Action Plan, particularly the action programs related to control of flooding, disaster preparedness and response and other specific actions that tackle climate change-related issues. At the same time, it is gearing up to further strengthen and adapt the existing ICM mechanisms, strategies and actions to meet new challenges and risks associated with the changing climate.

Engaging Stakeholders in Environmental Protection and Resource Conservation in Chonburi

Engaging the Private Sector in ICM Implementation in Bataan, Philippines[5]

In the province of Bataan in the Philippines, private-public sector partnership is an integral and significant aspect of ICM implementation. Seventeen companies including major oil, beverage, realty, shipyard and other corporations as well as a maritime academy compose the Bataan Coastal Care Foundation Inc. (BCCFI), which provides technical support, management expertise and counterpart funding to the Bataan ICM Program to build better coastal governance, increase awareness and promote community participation in coastal and marine environmental and resource management. In cooperation with the provincial government, 11 municipalities and other stakeholders, the BCCFI undertakes and/or supports tree planting activities, mangrove rehabilitation, sea turtle conservation, coral reef rehabilitation, establishment of fishery reserves/sanctuaries, coastal clean up and educational activities in various areas in Bataan. More than 40 ha have been replanted with mangroves by over 5,000 volunteers from different sectors, while more than 80 ha of fish sanctuaries have been established in the municipalities of Orion, Mariveles and Limay. BCCFI and its member companies also are implementing various programs to improve emissions, effluents and waste management, waste reduction and recycling, water management, energy efficiency and environmental compliance. Through varied approaches and entry points, BCCFI serves as a committed partner of the government and a catalyst in addressing concerns in the marine and coastal environment in Bataan and the Manila Bay at large, including the challenges of climate change.

Box 1. The private-public sector partnership in Bataan is an integral element of the Bataan ICM Program. The Bataan Coastal Care Foundation, Inc. consists of the following:

- Ayala Land, Inc.
- Core Maritime Corp
- Grand Asian Shipyard, Inc.
- Herma Shipyard, Inc.
- Limay Grinding Mill Corp.
- Liquigaz Philippines Corporation
- Maritime Academy of Asia and the Pacific
- NPC Alliance Corporation
- Orica Philippines, Inc.
- Petron Corporation
- Petron Foundation, Inc.
- Philippine Resins and Industries, Inc.
- Grand Planters Products
- PNOC- Alternative Fuels Corporation
- San Miguel Corporation
- Total (Philippines), Corp.
- Oilink International

Sustainable tourism development and disaster mitigation within the ICM context in Bali, Indonesia[6]

Bali Island is one of the foremost tourism destinations in Indonesia, with rugged coastlines, white sandy beaches and panoramic hills and mountains providing a picturesque backdrop to a colorful and deeply spiritual culture. Called 'Island of the Gods,' it offers a breadth of opportunities and experience for visitors especially from overseas. The rapid tourism development, however, comes not without a price — waste generation, pollution of coastal waters, decreasing fisheries, deterioration of coral reefs, loss of mangroves, beach erosion, and damage of cultural values, among others, all of which are increasing the island and its people's vulnerability to natural disasters and other potential impacts of climate change.

In Sanur, Denpasar Municipality, one of the focal areas for coastal recreation and tourism in Bali, implementation of a beach conservation program within the framework of the ICM program aimed to rehabilitate the eroded beach, as well as to develop a sustainable tourism destination in the coastal area. With the strong commitment of the local leader of Denpasar Municipality, an interagency and multisectoral coordinating mechanism and a shared vision and long-term coastal management strategy based on ICM principles were adopted, an integrated land and sea use plan was developed and integrated into the Regional

Land Use Plan, a Strategic Plan for Coastal Disaster Impact Mitigation was developed, and a Disaster Management Board was created. In 2005, with the awareness of the high vulnerability of Denpasar coastal areas to coastal hazards in view of its physical aspects, infrastructures, socioeconomic conditions, demography and institutional structures, a coastal disaster impact mitigation program was developed and implemented by the Denpasar Government in collaboration with the communities and other stakeholders. The program includes initiatives to prevent or minimize risk or increase disaster resiliency through both structural and non-structural means. The Denpasar government also supported strong and consistent law enforcement for coastal pollution control, government investments on sewage treatment and a public-private partnership on solid waste management.

To restore Bali's coral reefs, mangroves and other habitats and resources, a co-benefit approach to ecosystem restoration and rehabilitation and intensive stakeholder education and awareness campaign were employed to mobilize various stakeholders from the traditional villages, private sector, academe and NGOs. Bali is in the process of further strengthening ICM implementation in the entire province in the light of new national laws on management of coasts and small islands (NA 27/2007), spatial planning (NA 26/2007). The Bali Coastal Strategy and its implementation plan will also be updated in light of new conditions and concerns including climate change.

The coastline of Sanur before and after the beach rehabilitation and conservation project.

Enhancing disaster prevention and mitigation through the ICM program in Danang, Vietnam[7]

In Danang, Vietnam, which is usually directly affected by typhoons and tropical low pressures with serious consequences, the important role of ICM in addressing risks to the city's sustainable development, including natural disasters, was already recognized even before climate change became a global issue. In the Danang Coastal Strategy, natural disasters were identified as one of the threats in attaining the stakeholders' shared vision for the city, such that within the National ICM Demonstration Project in Danang City, activities relating to disaster prevention and mitigation were implemented including:

- public awareness programs on disaster prevention and mitigation;
- identification of areas vulnerable to erosion and flooding and relocation of settlers to safer areas;
- intensifying urban greening and reforestation efforts;
- enhancing meteorological capacity for typhoon, water level and flood forecasting;
- improving communication systems for fishing boats;

- strengthening and developing infrastructures such as dykes, shelter houses and shelters for boats;
- promoting energy conservation and use of alternative energy; and
- passing priority policies on waste recycling and reuse and cleaner production.

Climate change concerns have also been integrated into the other programs of the city including those on population, food security and poverty alleviation. In the course of ICM implementation and in the face of the increasing consequences of climate change-related events, the local government confirmed that effective adaptation to the impacts of climate change is a top priority in order to secure the people's safety and the sustainable development of the city. As the catastrophes caused by climate change may occur with even greater intensity and frequency in the future, more actions for the prevention and reduction of damages due to natural disasters, which is the main focus of climate change adaptation in Danang, still need to be undertaken. The first phase of the National ICM Demonstration Project in Danang City contributed a lot to the actions to adapt to the impacts of climate change in the city. The activities of the project in the second phase will be integrated into the city's plan for climate change adaptation.

Typhoons, flooding, and increasing salinity of rivers are among the major concerns in Danang. The city developed 4 multipurpose shelter houses and 88 model houses that can withstand forceful typhoons, and guided residents in building houses following the model houses. At the end of 2008, the city has also strengthened 6,500 m of dyke to prevent saline waters from affecting agricultural crops.

Providing scientific inputs and guidance in the development of community level adaptation program in Gubat, Sorsogon, Philippines[8]

In the municipality of Gubat, Sorsogon Province, Philippines, a scientific study on vulnerability of specific sites to impacts of climate change was adopted as a guide to designing and implementing programs and activities on disaster risk reduction and climate change adaptation by the concerned *Barangay* Councils (village councils) through official resolution(s). The research activities, which revolved around policy analysis, socioeconomic evaluation, training needs assessment, engineering structures appraisal for readiness to climate change, geo-physical environment characterization and cost-benefit analysis, generated robust on-the-ground information that served as basis for policy recommendations and adaptation options for enhancing the readiness of the project site for potential climate change. Through wave modeling, the study also showed that even if sea level was increased by one meter and wind velocity raised by several orders of magnitude, healthy coral reefs were found to be still effective in dissipating the energy of storm-generated waves, highlighting the role that coastal

ecosystems, particularly coral reefs, seagrasses and mangroves play in providing natural protection to coastal communities to buffer against high energy waves.

Targeted public awareness campaigns facilitated greater appreciation for the economic and ecological importance of coastal ecosystems by the people. Local government involvement starting from physical assessment and site selection, and trainings on the importance and strengthening of disaster preparedness, appropriate planning and legislations, and coastal environment protection and fisheries management in relation to climate change adaptation were critical in obtaining support for the study and its recommendations. However, as coastal degradation is caused by the interplay of several factors, such as pollution and siltation which also depend upon upland activities and conditions, an integrated approach is imperative.

Draft model Barangay Resolution (Brgy. Bagacay, Gubat, Sorsogon)

Republic of the Philippines
Province of Sorsogon
Municipality of Gubat
Barangay Bagacay

Resolution No. ___ S. 2008

A RESOLUTION ADOPTING THE STUDY OF THE MARINE ENVIRONMENT RESOURCES FOUNDATION (MERF) AS GUIDE TO DESIGNING AND IMPLEMENTING PROGRAMS AND ACTIVITIES ON DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION

. . . . . .

RESOLVED, as it is hereby resolved, to adopt the study conducted by MERF as guide to designing and implementing programs and activities on disaster risk reduction and climate change adaptation, especially with respect to land-use zoning, design of infrastructure for public use, protection of the coral reefs and other marine ecosystems, adoption of appropriate agricultural/fishing methods, protection of clean water sources, prevention of health hazards, and prevention of floods and landslides;

FURTHER RESOLVED, that Barangay officials should use the study as guide to giving feedback to municipal, provincial and national agencies, as well as private developers, conducting consultations on proposed development projects in Barangay Bagacay. No endorsements or permits shall be issued to projects or activities that are inconsistent with the recommendations of the study;

RESOLVED FINALLY, that Barangay officials shall disseminate the key findings of the study to the residents in a language and manner that is understandable and accessible to them.

ADOPTED:

Developing site-specific adaptation measures to address local issues in Demak, Indonesia in collaboration with stakeholders[9]

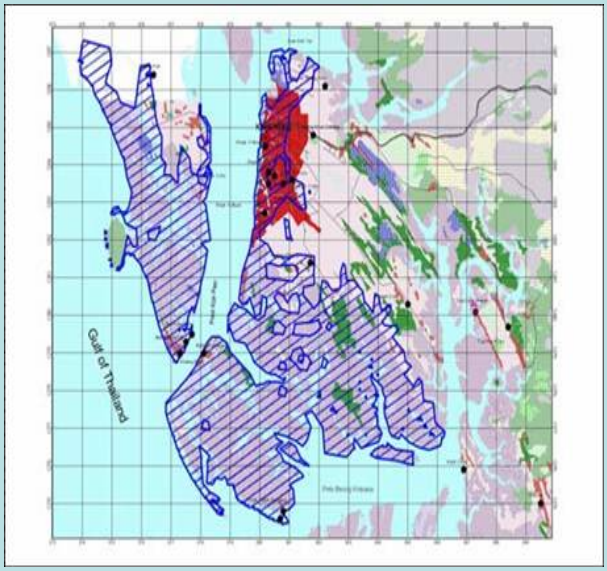
In Demak, Indonesia, extensive conversion of mangrove areas to shrimp and fish ponds and for construction of coastal infrastructure has caused coastal erosion leading to shoreline retreat of about 1.5 km and inundation of 660 ha of fish ponds and housing areas. Saltwater intrusion due to uncontrolled groundwater extraction and natural land consolidation also causes problems to the communities and agriculture. A 6 to 10 mm/year rise in sea level further exacerbates the rate of coastal erosion, inundation and saltwater intrusion, damaging village infrastructure and facilities, as well as fish ponds and agriculture areas. To reduce the impacts of these hazards, a combination of short-term and long-term countermeasures were implemented at the village level in collaboration with the villagers and with the assistance of technical experts. Using a participatory process, key issues were identified and an adaptation strategy was prepared together with the villagers.

Formulation of village development plan in Demak

A more detailed village management plan was also developed to facilitate the implementation of the strategy and guide the long-term development of the area, which includes short-term measures such as outreach and community awareness activities, rehabilitation of village infrastructure including roads, schools, houses, mangrove planting, use of bamboo as temporary breakwater to protect the mangroves, and house retrofitting by using stilts to protect from flooding and inundation. The focus on key issues and participation of the community from planning to implementation were key factors in their understanding of the initiative and participation in its implementation. Harmonization with district and national programs was also carried out in order to optimize available resources, although further assistance and guidance from the central government in accordance with national rules and regulations for addressing climate change, with participation from the provincial/district governments, collaboration from various parties and some funding assistance would facilitate further implementation of the plan in Demak. Other communities in the area have expressed interest to replicate the climate change adaptation efforts in Demak.

Vulnerability and adaptation assessment using models in Koh Kong Province, Cambodia[10]

For Cambodia, a vulnerability and adaptation assessment to climate change using global climate models from the Center for Climate Systems Research (CCSR) and Centre for Australian Weather and Climate Research (CSIRO) and emission scenarios SRESA2 and SRESB1 showed 1.35 to 2.5 ^{o}C increase in temperature in 2100 and 3-35 percent increase in annual rainfall. In Koh Kong Province, in particular, the rainfall in four main river basins is predicted to increase between 2 and 15 percent thereby increasing water flow by 2-10 m^3/s, and a 1-m rise in sea level would put 44 km^2 of the province (0.4 percent of total provincial area) permanently under water and about 56 percent of the settlement areas flooded. In addition to the profound damage to the coastal ecosystem and economies, potential economic loss from damage of infrastructure has been estimated at US$ 21 million. The potential impacts of climate change to the coastal zone, particularly Koh Kong's coast, could be reduced if adequate planning for responding to such phenomenon is considered and done well. Building on existing mechanisms and initiatives for management of the coastal area, various adaptation measures should be undertaken in the context of integrated coastal management, including conduct of necessary technical assessments, developing a master plan for the coastal zone, formulation of comprehensive adjustment and mitigation policies, development of information systems, increasing public awareness, and establishing cooperation frameworks for capacity development and information sharing. Policy makers should also be involved in the evaluation and enhancement of current programs to address current and future climate risks.



With a 1-m rise in sea level, 44 km^2 of Koh Kong Province will be permanently under water and 56 percent of settlement areas will be flooded.

National Strategic Response: Developing a National Framework for Climate Change Adaptation in China[11]

In China, coastal communities also face a lot of challenges related to climate variability including more vulnerable ecosystems, more storm surges, sea level rise, abnormal water temperatures and changing species compositions and distributions, among others, with significant socioeconomic impacts. This has prompted the central government to develop and issue the Framework for Adaptation to Climate Change in China on June 2007, which aims to eliminate management gaps and focus on reducing vulnerability and increasing adaptability of marine ecosystems to climate change using ecosystem-based approaches. Primary implementation measures in the coastal areas include:

- enhancing legislation and establishing integrated management demonstration sites;
- developing technologies on ecosystem restoration, biodiversity conservation and vulnerability reduction and transferring these to local communities;
- capacity building for marine environmental monitoring and early warning, and
- enhancing adaptive measures to sea level rise including engineering and biological strategies such as shelter belt.

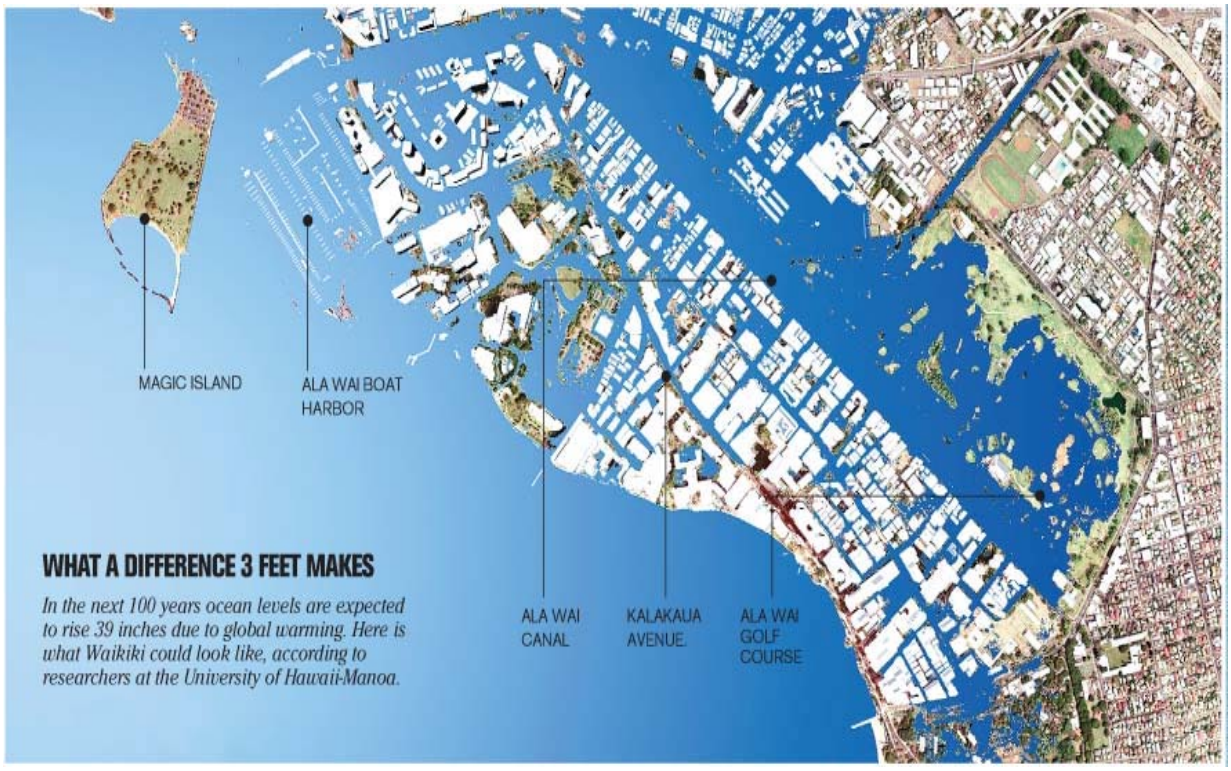
Mangrove and coral transplantation activities are being done in various areas in order to reduce the vulnerability of coastal areas from impacts of natural disasters and sea level rise.

Transplantation of corals in Sanya and mangroves in Beihai, Guangxi, PR China.

Implementing 'no-regrets' adaptation measures in Hawaii[12]

In Hawaii, sea level rise presents the most immediate concern to coastal managers, with mean sea level rise estimates of 0.24 m by 2050 and 1 m by 2100 in the state's 2007 Multi-Hazard Mitigation Plan. In sandy shorelines, a multiplier of 150 is to be applied, which would result in a retreat of 36 m to some vulnerable beaches by mid-century. Some of the short-term impacts of sea level rise in Hawaii include: beach erosion and retreat; increased flooding in coastal areas; reduced access to shoreline attractions; threats to key infrastructure including roads, sewers, storm drains and electrical lines; and threats to freshwater aquifers.

As Hawaii's economy is highly dependent on the visitor industry, these impacts, particularly the loss of vulnerable beaches, poses economic and social costs to the state. Thus far, government responses have been incremental and focused primarily on beach erosion and the conventional designation of hazard zones. Current adaptation efforts include beach nourishment, setting of shoreline setback to at least 40 ft, designation of special coastal zone management area extending a minimum of 300 ft landward from the shoreline where land use requires county permits subject to coastal management policies and conditions, and mandated designation of tsunami zones, flood hazard zones and more rigorous building codes. Flood insurance in designated flood zones is subsidized in part by the federal government. Longer term adaptation efforts will require extensive technical analysis and careful deliberative process involving experts, managers, politicians and citizens. In the meantime, this should not delay action and implementation of reasonable 'no regrets' adaptation measures, such as variable setback lines, enlarged hazard zone reflecting the latest technical analysis and coastal land acquisition by government or private conservation organizations.



Governing resilience building in Thailand's tourism-dependent coastal communities: The role of stakeholder agency[13]

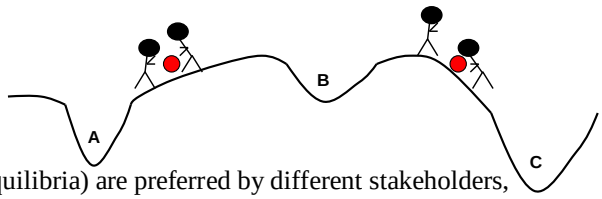
The importance of integrating formal and informal governance to address underlying hazard vulnerabilities was the key recommendation of a study that aimed to understand why underlying socioeconomic vulnerabilities to natural hazards persist in Thailand's tourism-dependent coastal communities despite radically improved institutions and policies expected to improve disaster risk reduction (DRR) and early warning following the 2004 Indian Ocean Tsunami[)].

While formal governance measures for resilience building were institutionalized in these communities, the study showed some shortcomings of post-tsunami recovery and DRR strengthening initiatives. These include:

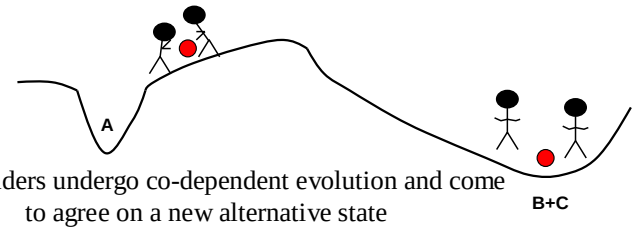
- persistence of pre-existing weaknesses in government structures and processes; funding shortages and misappropriation;
- misconceptions on who are vulnerable, technical and other shortfalls of the early warning system;
- policies which have led to conflicts and increasing disparities among social groups;
- emergence of new vulnerabilities from the tsunami recovery process most notably among the marginalized social groups and
- differences in risk measurement and perception among 'insiders' and 'outsiders'.

In these areas, the most prominent source of post-tsunami resilience of communities has been innovative modes of stakeholder agency or informal governance mechanisms throughout the public, private and civil society sectors, including tourism bodies, enterprises, family-oriented business groups, NGOs, elite groups, influential families and others. However, such forms of collective action have largely remained informal and are often undermined by the formal governance system. On the other hand, while an informal stakeholder agency can be a positive driving force in building resilience, it can also undermine formal governance systems and cause their collapse at the local level. There was also a widespread problem of trust and absence of shared vision of desirable resilience among competing government, private and civil society sector stakeholders. Lack of monitoring and transparency also created the risk of unethical outcomes and exacerbation of underlying vulnerabilities. A platform to enable formal and informal governance and stakeholders with diverging perspectives and interests to negotiate jointly agreeable visions, pathways, roles and responsibilities for resilience building that would promote cooperation, ownership, transparency and trust is therefore considered an imperative.

Stakeholder agency as informal governance



Different states (equilibria) are preferred by different stakeholders, who seek to exert their agency to transform the society/community (push the red ball) toward their preferred state.



Stakeholders undergo co-dependent evolution and come to agree on a new alternative state

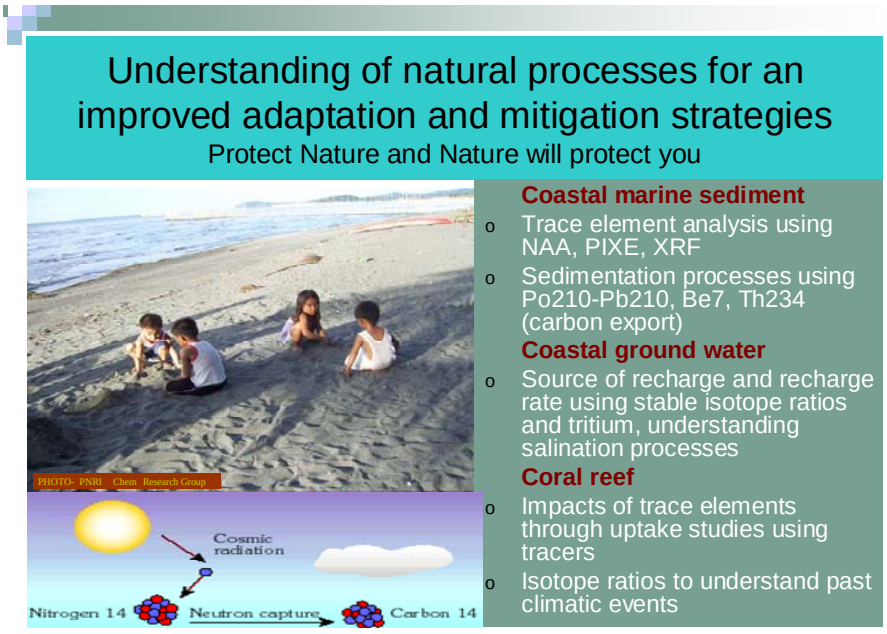
EMERGING APPROACHES AND NEEDS FOR CLIMATE CHANGE ADAPTATION FOR COASTAL AND MARINE AREAS

While practical adaptation measures are being implemented at the local level in collaboration with various stakeholders, technical analysis in support of longer-term adaptation efforts should be undertaken in parallel. In this regard, nuclear and isotopic techniques can be used to understand natural processes in order to improve adaptation and mitigation strategies. Advancements in modeling technology can now also generate climate scenarios at finer resolutions including subnational levels, which can be useful inputs in assessing impacts of future climate and formulating adaptation and mitigation measures.

Nuclear or isotopic techniques can be useful in studying natural processes[14] such as:

1. disturbance, sources and transport of marine sediments resulting from storm surges in the coastal area (using a combination of radiotracers such as ^{137}Cs, ^{210}Po, ^{210}Pb, ^{234Th} and ^{7}Be);
2. age of a sediment column and how fast sediment is accumulating in an area (using ^{210}Pb);
3. source of recharge and recharge rate of coastal groundwater and understanding salination processes (using stable isotopes and ^{3}H);
4. sources, ages and pathways of great ocean currents and water masses (using ^{14}C and ^{3}H);
5. ocean productivity and transfer of CO_2 (using ^{13}C, ^{15}N and ^{32}P);
6. impact of trace elements on coral reefs (using ^{65}Zn); and
7. understanding of past climatic events (using ^{13}C to ^{12}C ratio and ^{18}O-^{16}O data as temperature proxy.

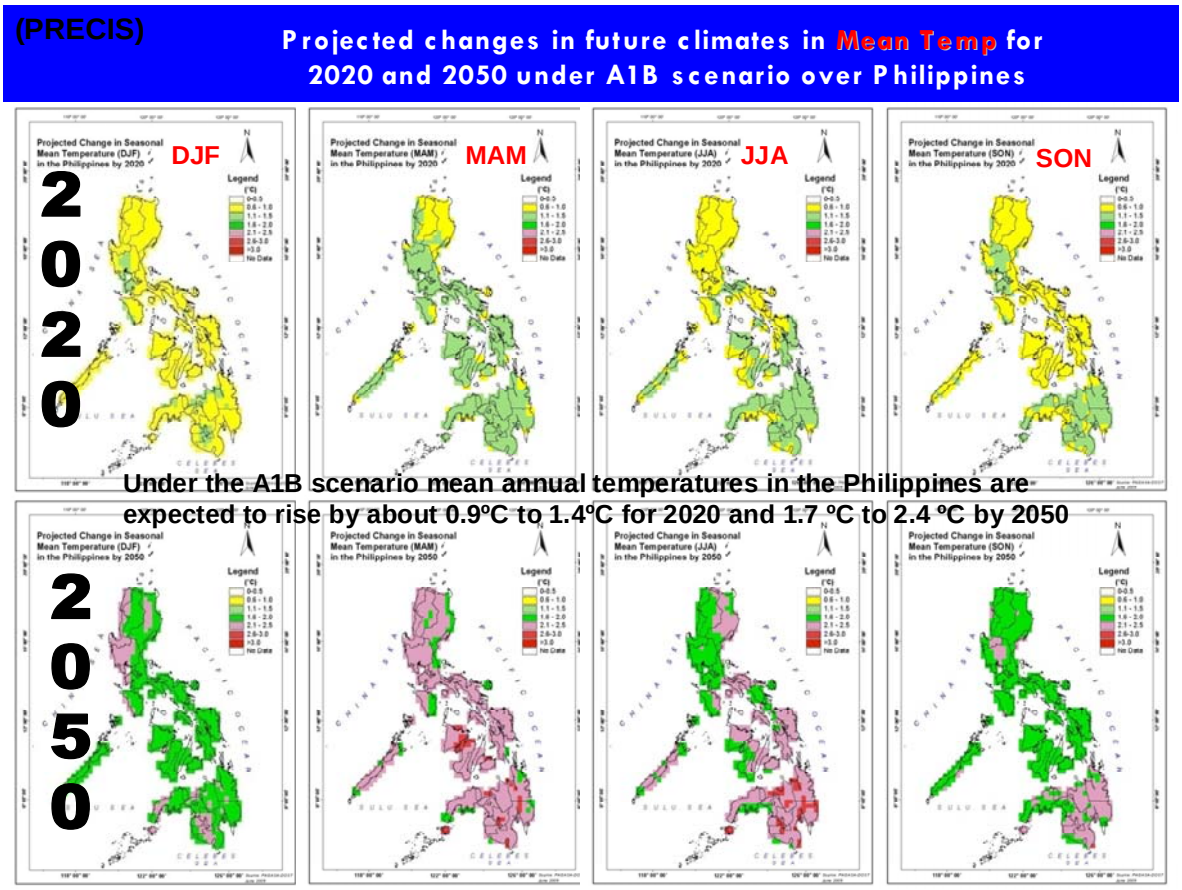
Various isotopes can also be applied for coastal and river basin management for assessment of water sources and water balance, residence time of water and sediments, groundwater tracing, groundwater-surface water interactions, erosion and sediment transport, nitrate sources and cycles, and transport and fate of metals. These information can be useful in understanding past and present events as well as for projecting and planning for future developments/events in the coastal area including those related to climate change.

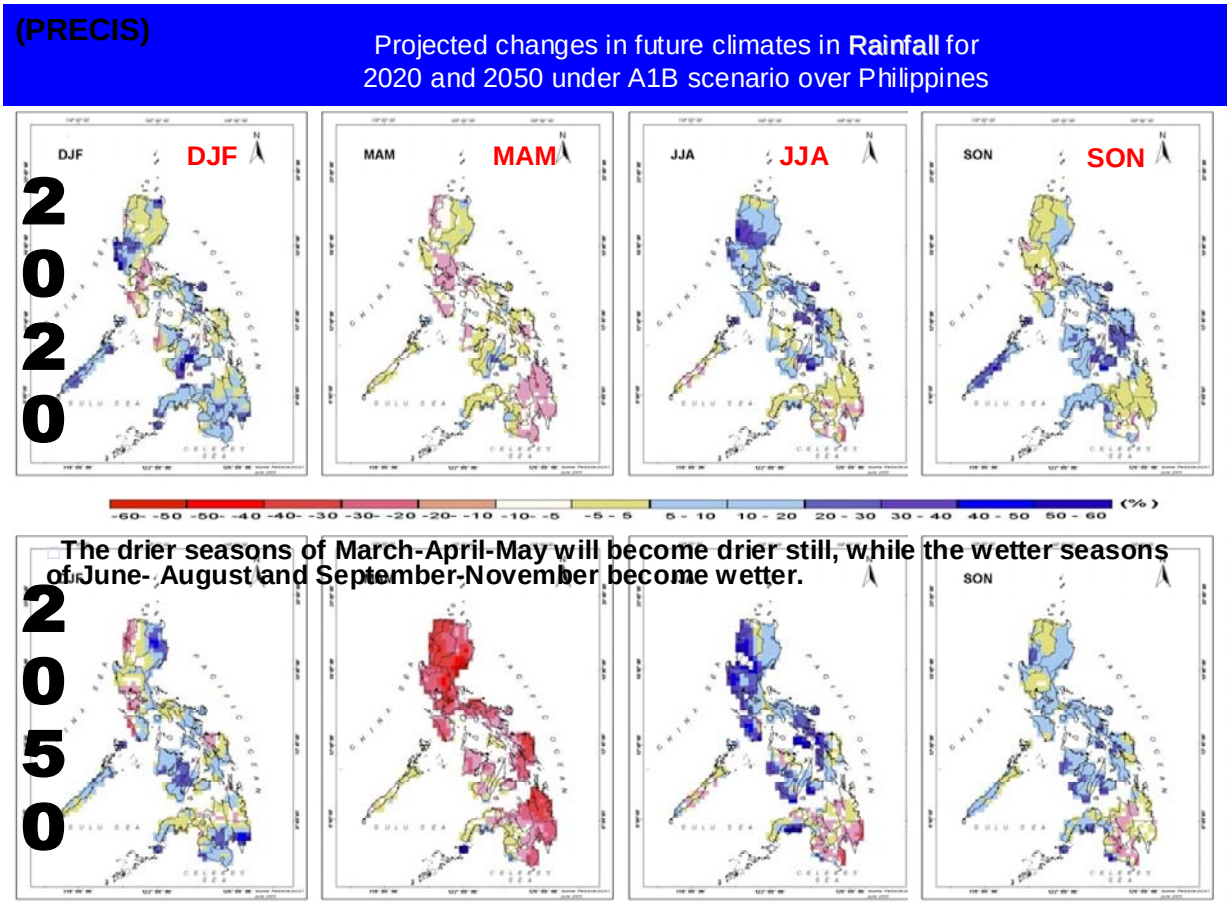


To simulate future climate change under various emission scenarios, coupled atmosphere-ocean global climate models (GCMs) are usually used. However, the grid resolution of the GCMs is typically around 200 km, which is too coarse to directly provide

realistic climate simulations for most islands, or regions with steep terrain or complex land use. An approach that has become common is to use regional climate models, driven in some manner by a coupled GCM, to simulate the climate at smaller length scales.

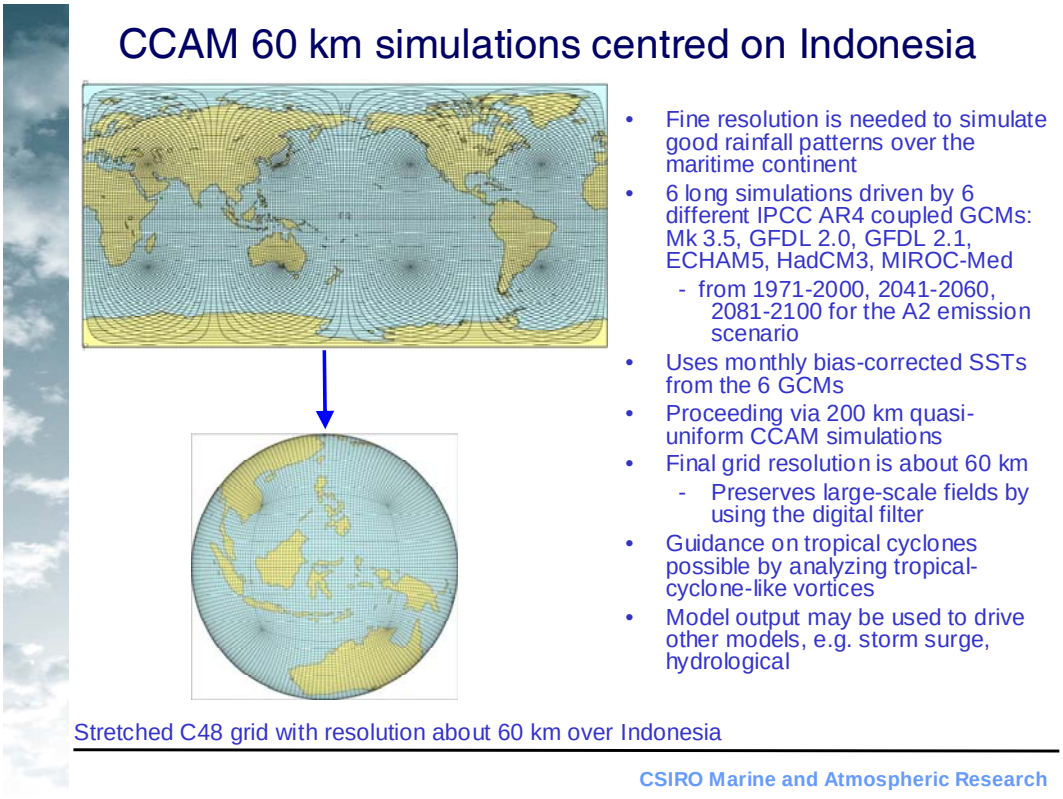
For the Philippines, a global climate model known as HadCM3 A1B scenario (developed by the United Kingdom Meteorological Office Hadley Climate Centre for Climate Prediction and Research, with a resolution of 2.5 ^{o} x 3.75^{o} or 150 x 300 km) was downscaled into a resolution of 0.44 ^{o} x 0.44^{o} using a regional climate modeling system known as PRECIS[15]. PRECIS (Providing Regional Climates for Impact Studies) was developed in order to help generate high resolution climate change information for as many regions of the world as possible. It is freely available to groups of developing countries in order that they may develop climate change scenarios to guide planning and implementation of climate change adaptation and mitigation programs. The regional climate model was used to generate baseline information for the Philippines for the period 1971-2000 and to simulate future changes in temperature and precipitation for two periods centered on 2020 (2006-2038) and 2050 (2039-2065). Climate change projection of temperature indicated that both minimum and maximum temperature will exhibit increasing trends both in 2020 and 2050 in relation to the A1B scenario, and that mean annual temperatures are expected to rise by about 0.9^{o}C to 1.4^{o}C for 2020 and 1.7^{o}C to 2.4^{o}C by 2050. The largest warming in the Philippines will occur in June-July-August (JJA), while in Mindanao it will be on March-April-May (MAM). With regard to rainfall, model projections showed that the dry period in the country (MAM) will get drier while the wet period will be wetter (JJA). Quantitative climate scenarios are used as inputs in the development of models for assessing impacts of future climate, and options for adapting to or mitigating such impacts.





For the last ten years, downscaling at the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) has been performed with a variable global atmospheric model, the Conformal-Cubic Atmospheric Model (CCAM), which can be downscaled from a variety of host models and scenarios[16]. A number of simulations were shown over the Australian region, showing the monsoonal precipitation response, including 140-year simulations (1961-2100) at 60 km and 20 resolutions, driven by the sea surface temperatures and sea ice distributions of coupled GCMs such as the CSIRO MMk 3.5 and five coupled GCMs from the IPCC Fourth Assessment, all for the A2 emission scenario. Downscaling was done by first running a quasi-uniform 200-km CCAM run driven by SSTs of GCMs, then downscaling the 200-km runs to 20 km by running CCAM with a stretched grid but applying a digital filter to preserve large-scale patterns of the 200 km run. The 20-km runs showed good agreement with observed present-day rainfall, as well as rainfall trends (1961-2000) that showed drying in most of Australia. With a good computer, downscaling can even go down to 2 km. 14-km runs over Tasmania downscaled from above 60-km CCAM runs were also used to provide the main climate change information for a large integrated assessment project for Tasmania. 60-km CCAM simulations were also performed over Asia, which captured the monsoon onset and its rainfall patterns well. A 60-km simulation centered on Indonesia can provide guidance on tropical cyclones and be used to drive other models (e.g., storm surge, hydrological, etc.). The 60-km simulations of present-day rainfall in Indonesia also showed improvements over the 200-km runs. Simulations of rainfall changes in 2080-2100 showed the tendency to become drier over Java and wetter over Sumatra. CCAM

simulations were performed using different GCMs to get a range of results and improve simulations. The Indonesia Meteorological Climatological and Geophysical Agency (BMKG) is already using the CCAM for regional climate modeling as well as for seasonal forecasting and weather prediction. The University of Hanoi has also started using CCAM for regional climate simulations. It is likely that PAGASA in the Philippines will soon use CCAM for regional climate simulation. CSIRO plans to perform long very high resolution simulations over Pacific Island countries, continue model improvements, and develop more collaboration including potentially a consortium over Southeast Asia, with annual workshops.



PANEL DISCUSSION AND OPEN FORUM

Following the presentations, a panel discussion and open forum highlighted the following points:

- Climate change is with us and cannot be decoupled from development. If we continue development as if climate change was not ongoing, we fail to adapt and we risk/endanger development.
- Adaptation is generally a local and site-specific suite of actions, and local governments need help to identify and adapt practical solutions.
- While decisionmaking, plans, and strategies on climate change adaptation need to have a science-base, we know enough to implement common-sense adaptation measures now, including educating the people, identifying vulnerable areas, enhancing shoreline protection, improving building standards, building flood-proof homes, and implementing rules and regulations, among others. There are generalized guidelines

regarding implementation of such practical measures that can be adapted to specific local areas. Traditional knowledge of local communities can often be used for identifying specific adaptation actions together with other scientific information which needs to have the appropriate high resolution

- In parallel with the implementation of practical adaptation measures, there is also a need to systematically compile data/information to serve as basis for anticipatory adaptation and selection of appropriate adaptation measures. With technological advances in computer modeling, climate scenarios with high resolutions can now be generated for use at subnational levels. Extended time-series observations are needed to identify and separate the various signals of change, including climate change. In this context, traditional knowledge can be very important to collect and use.
- Capacity needs to be built in the countries on the use of such models and interpretation of results, and investments will be needed for information, data, equipment and human resources. International and regional cooperation, networking, and shared research and development would be useful.
- In designing and implementing programs and activities on disaster risk reduction and climate change adaptation, local governments and their constituencies must be involved from the start, and jointly plan and implement the program including the allocation of funds. Strategies and actions should be harmonized, and roles of local government and communities should be defined, including who will take care of what when". Advocates who can push for the right policies should also be identified.
- Together with providing appropriate and reliable technical data in understandable and useful forms, scientists should also learn how to deal with the communities and learn about traditional ecological knowledge. Enhancing communication among local people, managers and scientists should be part of ICM capacity building.
- Perception and attitude change is also needed both for the local communities, the managers and the scientists with respect to integrated management and human security, and the association of development, poverty alleviation and climate change.
- The high population density in coastal areas, which leads to a relatively higher population increase compared to inland, and the overall demographic development is a factor to be taken into account in the socioeconomic management actions.
- Several leading industries active in the coast, e.g., tourism and insurance, are highly motivated to be associated with ICM and climate change adaptation measures including at the local level; the incentives being co-benefits, proactive disaster management and risk reduction for life, infrastructure and environmental protection.
- Co-management involving local government units and communities is a good model to pursue in ICM and adaptation actions including in relation to ecosystem services, preservation and re-establishment
- Adaptation measures need to be included in national and local development and strategic plans. Mainstreaming of climate change adaptation and disaster risk reduction need to be in accordance with national and local policies and legislations, and need to ensure harmony between national and local government plans and rules. Dialogue between national and local governments can be useful.
- ICM is an accepted framework in the coastal area, with demonstrated ability to generate and support development. The ICM approach can also meet the needs to address climate change adaptation and disaster risk reduction, including mainstreaming these into local government development plans. ICM tools and methodologies can be enhanced further to enhance its ability to support climate change adaptation and disaster risk reduction

RECOMMENDATIONS

In closing, the workshop came up with the following recommendations:

- ICM is a good approach to address climate change adaptation measures and development.
- Local adaptation, using existing ICM tools such as setbacks, hazard zones and permits can begin now based on existing climate change science.
- Local governments and their constituencies must be involved from the start and jointly plan the allocation of funds and budget specifications, with joint decisions on use of funds; local governments have the political will to implement executive orders given sufficient resources.
- Scientists need be trained in communication with local communities and local governments and adjust to the local needs, adaptation being site-specific.
- Awareness creation and education at the local level — with capacity building generating direct involvement in actions such as beach, fisheries, coral reef, mangroves and seagrass beds protection — can lead to an attitude and behavior change and public pressure on local governments to take necessary action in the context of environmental management.
- Adaptation needs higher resolution information and capacity to develop such, including through computer modeling and investments in computer facilities, and human resources development to use these and develop and interpret model scenarios and climate projections.

PRESENTATIONS

1. Tae Yong Jung. “The Economics of Climate Change in Southeast Asia: A Regional Review.”
2. Francisco, H. and A. A. Yusuf. “Climate Change Vulnerability Mapping in Southeast Asia.”
3. Ross, S.A. “ICM for Climate Change Adaptation and Sustainable Development.”
4. Kanchanopas-Barnette, P.,* C. Thimkrajang, and K. Chalermwat. “Enhancing Multi-sectoral Coordination and Stakeholder Participation for Sustainable Coastal Development and Climate Change Adaptation in Chonburi, Thailand.”
5. Baylon, A. “Addressing Climate Change Concerns in Bataan Province and Manila Bay through Private-Public Partnerships: The Bataan Coastal Care Foundation (BCCFI) Experience.”
6. Sastrawan, A.A.G.A. “Integrated Beach Conservation for Sustainable Tourism Development and Disaster Mitigation Impact in Denpasar Municipality, Bali, Indonesia.”
7. Dieu, N. “Effectiveness of Integrated Coastal Management Towards Climate Change Adaptation in Danang, Vietnam.”
8. David, L.,* P. Aliño, M. Atrigenio, C. Villanoy, F. Siringan, M. Fortes, J. Kho, M. A. Tanchuling, A. Cruz-Trinidad, M. F. Varona, A. Yniguez, E. Celeste, K. Cordero-Bailey, O. Cabrera, Y. Sta. Maria, A. Almo, M. Magno-Canto, and C. Nanola. “Climate Change in Coastal Areas: A Community-based Adaptation Approach.”
9. Diposaptono, S.,* and F. Agung. “Climate Change Adaptation in Coastal Areas Based on Local Issue and Community Participation — Case Study at Demak District, Indonesia.”
10. Navann, O. “Climate Change Impacts and Adaptation Measures in the Cambodian Coastal Zone.”

11. Wen, Q.,* Z. Zhang, J, Li, and L. Mu. “Developing the Capacity of Coastal Areas to Adapt to Climate Change through Ecosystem-based Approach.”
12. Lowry, K. “Local Climate Change Adaptation Measures in Hawaii.”
13. Klocker Larsen, R.,* E. Calgaro and F. Thomalla. “Governing resilience building in Thailand’s tourism-dependent coastal communities: The role of stakeholder agency.”
14. Sombrito, E.,* and J.S. Lee. “Nuclear and Isotopic Techniques in Natural Hazards Associated with Climate Change.”
15. Hilario, F.,* R. de Guzman, T. Cinco, E. Ares, P. Nilo and N. Servando. “Climate Trends and Climate Change Projections in the Philippines.”
16. McGregor, J.,* K. Nguyen, J. Katzfey and M. Thatcher. “Development of Climate Change Projections in Southeast Asia.”

Panelists

- Dr. Kem Lowry, Department of Urban and Regional Planning, University of Hawaii,
- Dr. John McGregor, Centre for Australian Weather and Climate Research, Aspendale, Australia