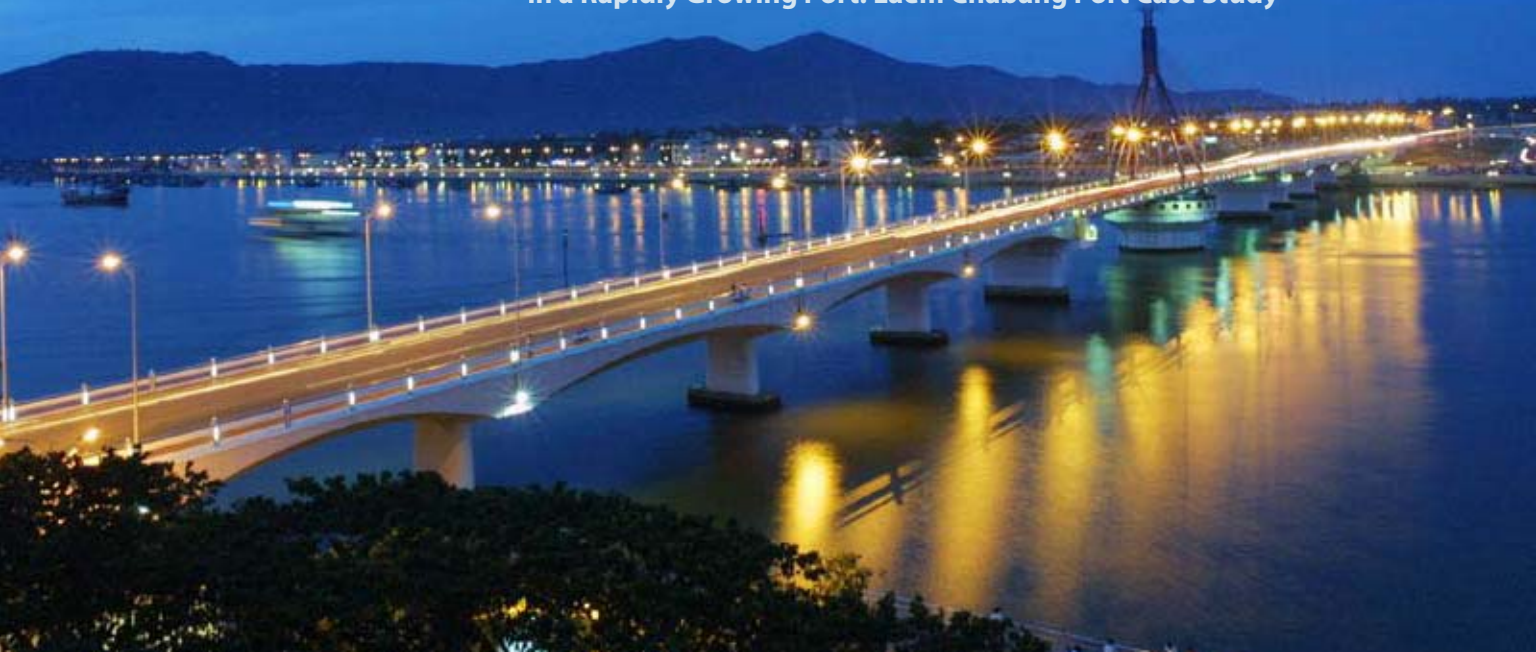
tropical coasts

Vol. 17 No. 2 ISSN 0117-9756 July 2012

Scaling up Integrated Coastal Management: Case Studies in Sustainable Development

- Sustainable Development, Climate Change Adaptation and Disaster Risk Reduction: A Case Study in Danang, Vietnam
- Greening Ports: Bangkok Port's Experience and Achievements
- Sustainable Tourism Development: Case Study in Denpasar Municipality, Bali, Indonesia
- Beach Management as a Contribution to Sustainable Tourism in Sihanoukville, Cambodia
- Mobilizing Stakeholder Participation and Ownership through ICM: Lessons from Chonburi, Thailand
- Safety, Health, and Environmental Improvement Programs in a Rapidly Growing Port: Laem Chabang Port Case Study



Responding to growing challenges

After 18 years of implementation, there are more specialized and prioritized applications of integrated coastal management (ICM) in the region. Greater understanding and appreciation for ICM has led to its usage in addressing emerging concerns like climate change and increasing public demand for sustainable industries. As these phenomena are anchored on coastal and marine ecosystems and resources, ICM is able to provide the solutions that will maintain the health of the environment and ensure the development of coastal communities.

This issue of *Tropical Coasts* expounds on different cases across the region that highlight the contributions of integrated and holistic management for sustainable development of coastal communities and sectors of the economy that are highly dependent on coastal resources. It features how the scaling up of ICM builds the capacity to adjust and respond to the growing challenges of a changing environment in Danang and Chonburi and contributes to the sustainable tourism in Bali and Sihanoukville. The issue also covers the implementation of the Port, Safety, Health and Environmental Management System (PSHEMS) in two major ports in the region.

The *Sustainable Development, Climate Change Adaptation and Disaster Risk Reduction* article discusses how Danang, Vietnam, addresses the threat of climate change in the province through ICM. Because of its geographical features, Vietnam, particularly Danang, is very vulnerable to the impacts of climate change. These impacts are already occurring as it has been observed that there are increasing weather disturbances and resulting natural disasters. Along with the national government's programs and strategies on natural disaster mitigation and climate change, Danang's coastal strategy and its implementation plan responds to climate change with measures that will build the necessary framework and strengths needed to deal with this large-scale event.

Another site that demonstrates the benefits of long-term ICM implementation is featured in *Mobilizing Stakeholder Participation and Ownership through ICM: Lessons from Chonburi, Thailand*. As a major industrial manufacturing and trade center, Chonburi province has experienced issues commonly associated with rapid economic growth, such as conflicting use of resources, habitat degradation and pollution. In order to address these problems, the provincial government identified the need for an integrated and holistic solution to coastal management. The article focuses on the ten years of experience and lessons learnt in the implementation and scaling up of ICM in the Chonburi province.

Integrated management is not limited solely to coastal communities. *Greening Ports: Bangkok Port's Experience and Achievements* discusses how an accident spurred the Port Authority of Thailand to reevaluate their standards and procedures eventually leading to its attainment of Port, Safety, Health and Environmental Management System (PSHEMS) Recognition from PEMSEA. Due to its accomplishments and results in line with PSHEMS, Bangkok Port has experienced numerous benefits and remains committed to continual improvement.

In Chonburi province, another major port of Thailand has also undertaken improvements to address the common issues that arise from port activities (*Safety, Health and Environmental Improvement Program in a Rapidly Growing Port: Laem Chabang Port Case Study)*. As Thailand's most important deep sea port and the future main trading gateway of Indochina, the success of Laem Chabang Port's operations is based on how it will handle the safety, health and environment concerns that it faces. Since 2008, the Laem Chabang Port has implemented the PSHEMS and a number of environmental and safety/health programs. These initiatives have already produced positive results, as detailed in the article.

Aside from ports, tourism is another industry that relies on the sustainable management of coasts. The tourism industry of Bali is deeply intertwined with coastal resources. The increasing number of tourists is accompanied by mounting environmental pressures from these human activities. The *Sustainable Tourism Development: Case Study in Denpasar Municipality, Bali, Indonesia* explains how the ICM program in the municipality contributes to the government programs and investments that aim to conserve the coastal areas that are not only economically important but socioculturally relevant as well.

The ICM site of Preah Sihanouk has also realized the importance of developing a tourism industry in line with the principles of sustainability. *Beach Management as a Contribution to Sustainable Tourism in Sihanoukville, Cambodia* highlights how a comprehensive tourism development and management in Occheauteal Beach improved the coastal areas that were impacted by Preah Sihanouk's growing tourism industry. The zoning plan not only addressed the environmental issues caused by uncoordinated building of structures and facilities but also contributed to growth of the province's tourism industry.

What is evident with these cases is that the scope of ICM implementation is growing. The case studies show that through ICM programs, the local governments and ports were able to maintain a balance between economic development and environmental and social demands and harness the potential that ICM offers. It is hoped that the experiences and lessons shared in these case studies will contribute to the replication of ICM across the region.

Contents

S. Adrian Ross
Editor

Anna Rita Cano
Assistant Editor

Jonel Dulay
John Christian Castillo
Design/Illustration/DTP

ICM PMO, DONRE
Danang, Vietnam
Cover Photo

Nicole Marie Afable
Jane Desiree Andal
Dwight Jason Ronan
Research

Contributors
Aunporn Poopetch
Belyn Rafael
Buncha Apai
Chatchai Thimkrajang
Do Manh Thang
I Ketut Sudiarta
Kashane Chalermwat
Nguyen Dieu
Pham Thi Chin
Phan Thi Thu Thuy
Prak Visal
Praparsiri Kanchanopas-Barnette
Sally Nay
Thongchai Thammapredee
Truong Cong Hai

The next issue will cover the Thematic Workshops of the International Conference of the East Asian Seas Congress 2012 held in Changwon CIty, RO Korea.

The Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Global Environment Facility (GEF), United Nations Development Programme (UNDP), United Nations Office for Project Services (UNOPS) publish Tropical Coasts Magazine biannually. The publication is geared towards stimulating an exchange of information and sharing of experiences and ideas with respect to environmental protection and the management of coastal and marine areas. Readers are strongly encouraged to send their contributions to:

Editor
P.O. Box 2502,
Quezon City 1165,
Metro Manila, Philippines

ISSN 0117-9756

tropical coasts
Vol. 17 No. 2 July 2012
www.pemsea.org

Sustainable Development, Climate Change Adaptation and Disaster Risk Reduction: A Case Study in Danang, Vietnam

By Nguyen Dieu, Danang Department of Natural Resources and Environment (DONRE); Pham Thi Chin, Do Manh Thang, Truong Cong Hai, Phan Thi Thu Thuy, ICM Project Management Office staff, DONRE, Danang, Vietnam

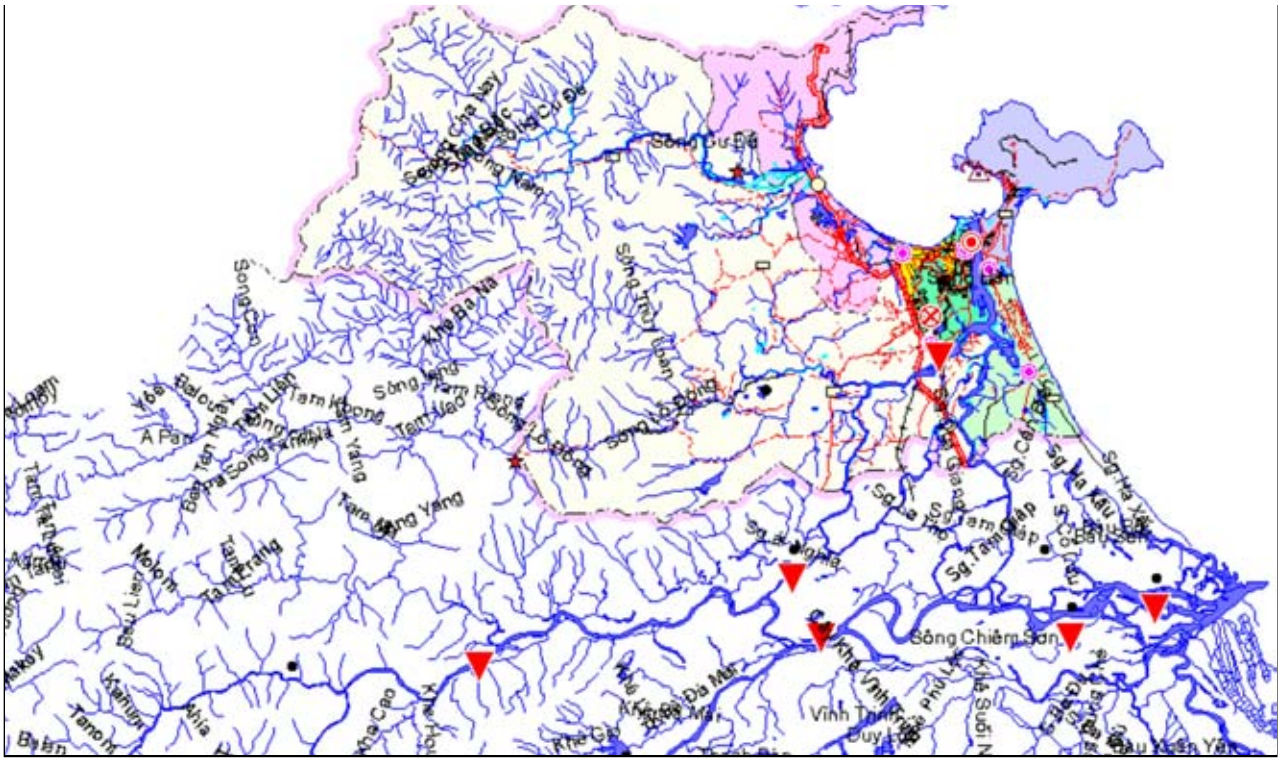
Climate change is a global issue and it is becoming one of the most serious challenges facing humankind in the 21st century. Climate change affects economic development, the environment and natural resources, human lives, health and properties as well as livelihoods. In recent years, climate change and other extreme climate phenomena have been occurring with increasing frequency and intensity causing serious consequences to many coastal provinces and cities.

Why Danang is vulnerable to climate change

According to the World Bank, Vietnam is among the countries that will be most affected by climate change. Danang City, in particular, is vulnerable due to its geographical location. The city is located in central Vietnam, which is usually affected by typhoons, tropical low pressures formed from the East Sea, and the northeast monsoon. The city also receives heavy rainfall, particularly during October and November. Aggravating the situation is the limited drainage capacity of its many rivers and streams (**Figure 1**). For example, the area of the coastal plain affected by flooding is about 500 km^2 while the area of the valley that receives water from the Vu Gia and Thu Bon river system, where Han River originates, is very large — nearly 5,180 km^2, about tenfold of the flood-affected area. The drainage capacity of the plain is therefore very slow, causing floods. In addition, some areas of Han River, particularly near the sea, have long been filled up with silt and sand deposits. In addition, there are many construction works and structures along the riverbank, such as stone embankments, bridges and the port, which affect the current and water flow near the estuary, further decreasing drainage capacity. The inappropriate exploitation of forest resources has reduced the natural function of the forests as buffers against strong winds and flooding. **Box 1** provides information on the physical features (i.e., geographical, topographical and hydrological) of Danang.

Finally, the distribution of residents in the city also plays a role in its vulnerability. The highest population density is located in the urban districts within a small and narrow coastal valley (**Figure 2**). The urban districts make up 20 percent of the total land area of Danang but support 87 percent of the city's population. The major social, economic and political infrastructures of Danang are located in the urban area.

Figure 1: The river system in Danang City.



Current situation and trends

Based on observed data and available information, changes in climate in Danang follow the general trend of climate change in the region and worldwide. In particular, there is an observed change in temperature, rainfall, drought, typhoon frequency and salinity intrusion.

Increase in temperature and drought

In the past decade, the average annual temperature of Danang increased by 0.3°C; in summer, the average temperature increased by 0.6°C together with the temperature variations among months. **Figure 3** shows the fluctuation of temperature in the past 30 years (1976–2006).

It was further observed that in winter, the temperature decreased in the first months of the year and increased towards the last months of the year. In 2005 and 2006, long droughts occurred in Danang due to increased temperature and change of precipitation. The annual temperature in 2006 was 26.3°C and the highest temperature was 38.7°C. The prolonged drought seriously affected the paddy areas in summer–autumn crop, meanwhile in winter–spring crop, there were many cold spells (10-year Danang Environmental Status Assessment Report).

Box 1. Physical Features of Danang.

- Lies between latitudes 15°55′ and 16°14′N and longitudes 107°18′ and 108°20′E.
- Borders Thua Thien-Hue Province in the north, Quangnam Province in the south and west and East Sea in the east.
- Consists of six districts (Hai Chau, Thanh Khe, Lien Chieu, Son Tra, Ngu Hanh Son and Cam Le); one suburban district (Hoa Vang) and one island district (Hoang Sa).
- The Truong Son, Hai Van and Bach Ma mountain range makes up ¾ of the area of the whole city while the coastal plain makes up ¼ of the area, which is divided by many rivers and streams.
- Climate is a combination of the climatic features of the north and south, but the typical tropical climate of the south dominates.
- Annual average temperature is 25.9°C.
- Annual average rainfall is 2,505 mm
- Major rivers include Han and Cu De. Other rivers include Yen, Chu Bai, Vinh Dien, Tuy Loan and Pho Loc. Han River is the lower section of the Vu Gia and Thu Bon River system, the biggest in Central Vietnam.
- Water level at the upper reaches of the city is dependent on the season, while the lower sections are affected by tidal regime, which is semi-diurnal.
- The forested area makes up more than 40 percent of the land area.



Figure 2: Population density of districts in Danang City.

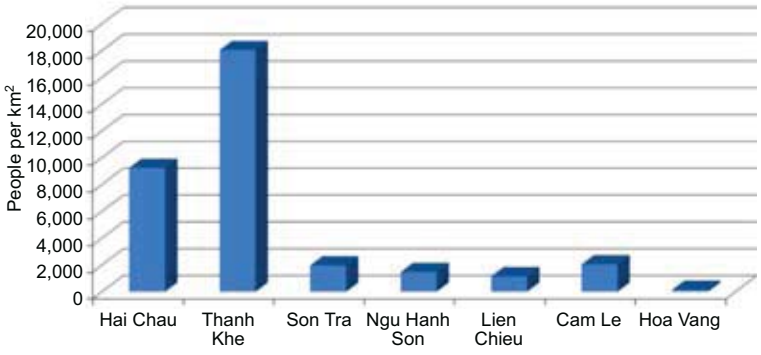
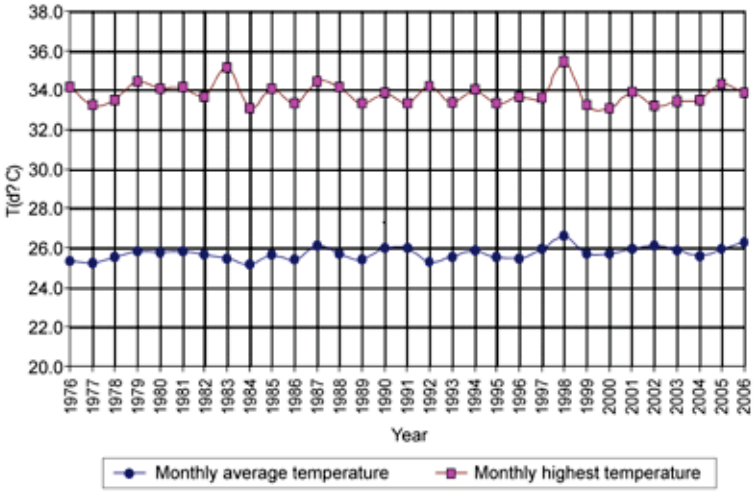
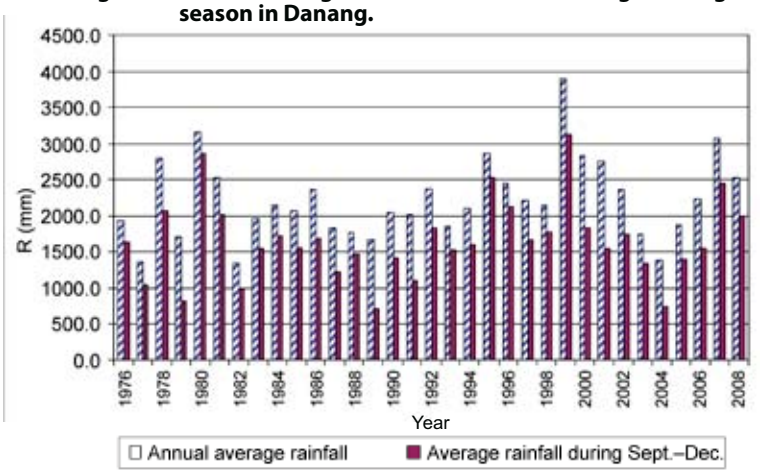


Figure 3: Temperature variations in Danang (1976 – 2006).



Source: Central Region Hydrometeorology Center).

Figure 4. Annual average rainfall and rainfall during flooding season in Danang.



Rainfall

The annual average rainfall in Danang was observed to be relatively stable in the last decade. However, in recent years, the monthly rainfall and the duration of rainy season have changed, particularly in 2005 and 2006 (**Figure 4**). In 2009, Danang experienced a heavy downpour above Level III (i.e., all low-lying areas are submerged, river protection dams are at risk and damage to infrastructure begins to occur) including one that reached approximately the level of the historic flood of 1964.

Typhoon frequency

Typhoons and tropical low pressures, which often occur in September to November each year, have directly affected Danang. Statistics showed that there are 3–4 typhoons and 2–3 tropical low pressures that affect the central region annually. Danang, in particular, experiences at least one typhoon and one tropical low pressure on average each year. In the four past decades, typhoons have been increasing. In the late 1980s and 1990s, there were about 16 and 12 typhoons that passed Danang, respectively. In 2005-2006, there were three typhoons with a wind force of over 11 on the Beaufort scale (over 103 km/hour), which made landfall in Danang. In 2006, Typhoon *Xangsane* hit Danang with a wind force of 12 on the Beaufort scale, which is considered the strongest typhoon since a monitoring system was established in Danang.

According to experienced fishers, recent typhoons are unpredictable both in path and intensity, hence their local knowledge and practical experiences in forecasting is no longer effective. According to Mr. Tran The Chinh, 75 years old in Group 3, Tho Quang Commune, Son Tra District, before, the fishing boats were not equipped with radio or any other modern equipment. Hence, they mainly responded based on their practical experience in predicting the typhoons. Recently, most fishing boats have been equipped with communication equipment to update fishers on the weather forecast and to facilitate rescue operations if they are already at sea.

Box 2. Socioeconomic Impact of Typhoon No. 6.

Although Danang City has capacity for disaster risk reduction, response and mitigation, Typhoon No. 6 (Xangsane) with its power and intensity, seriously damaged the city, and resulted in the following:

- 30 persons lost their lives and 61 people were injured
- 14,138 houses completely collapsed; 42,691 were seriously damaged; 65,271 houses were partially damaged
- 55 ships sank and 33 were seriously damaged
- 877 ha of rice paddies, trees and vegetable crops were damaged;
  18,466 ha of forest collapsed and 20,260 trees were destroyed
- 2,760 classrooms were partially damaged; 605 institutions/ organizations/agencies were seriously damaged
- Four radio broadcasting stations lost contact
- Three diesel generators stopped functioning, which completely blacked out peripheral electrical systems; 35,836 subscribers were without electricity; 75 transformer stations were shut down; 310 tension poles collapsed, and 351 km of middle and high tension electrical lines were broken.

The total estimated damages due to typhoon No. 6 were VND 5.290 billion or US$ 330.9 million (2006).

Box 3. Flood Damage in Danang.

The big flood in early November 1999 caused 37 deaths, 50,000 m^3 of broken dikes, 430,000 m^3 of broken drainage canals, and 24,000 m^3 of damaged water reservoirs. The total damage was up to VND 611 billion or US$ 43.9 million (1999).

From 1998-2008, erosion in several areas of Han, Cu De and Phu Loc River estuaries occurred, with a total length of eroded shoreline at 15.47 km and ranging in width from 0.5 m to 15 m.

Source: The Flood Control Search and Rescue Steering Committee.

Floods

Typhoons usually bring about serious flooding. In the past 34 years, Danang has experienced heavy and very heavy rains each year with a total average rainfall of 150 mm/hour, causing heavy flooding. In the urban areas, in particular, flooding occurs due to limitations in the capacity of the drainage system. On the average, there are about three to four floods each year, sometimes reaching to six to seven floods per year. From 1998-2009, there were six flashfloods that reached above Level III (i.e., all low-lying areas are submerged, river protection dams are at risk and damage to infrastructure begins to occur). Many elderly, who have been living for over 80 years in Danang, narrated that flood waters rose very quickly in recent times, leaving no time for the residents to secure their properties. Mr. Nguyen Dan, 77 years old, an experienced fisher who had been fishing in Vu Gia River observed that before, if there were heavy rains in the mountain, flooding occurred in the valley 3 to 4 days later. Now, even relatively lighter rains in the mountain are causing inundation in the valley at a very fast rate.

Salinity Intrusion

Salinity intrusion, particularly in rivers, is also becoming a problem during the dry season (April to July). According to the 10-year Danang Environmental Status Assessment Report (1997–2007), the annual salinity in Han River system is a cause for concern. From 1998 up to the present, salinity intrusion in river water has occurred at the lower section of Vu Gia River that runs through several smaller tributaries up to the mouth of Han River. The area covered supports a large population and agricultural land. According to Danang Water Supply Company, in recent years, salinity intrusion at Cau Do water supply station was recorded to occur for 15 to 20 days with the highest recorded value of 6,279.5 mg/L in 2005. Previous records showed that salinity intrusion occurred in 1 to 2 days with a salinity range of 23.4 mg/L to 35.1 mg/L.

The impacts of climate change in Danang are being felt and the sectors that are most affected are agriculture, water resources with consequential impacts on food security, public health and safety in the coastal and mountainous areas, and the environment and natural resources. Vulnerable communities include the farmers, fishers, ethnic minority groups in mountainous areas, as well as senior citizens, women, children and poor people living in urban areas. The serious impacts of climate

Box 4. Impacts of Climate Change.

Based on scientific projections:

Sea Level Rise:

- 30,000 households and 170,000 people at 17 communes and 400,000 existing houses will be affected

Floods and droughts:

- 700 ha of agricultural land will be affected by drought due to changes in precipitation; 500 ha cannot be cultivated;
- 700 ha of agricultural land along the lower stream of Vinh Dien and Yen River will be affected by salinity intrusion, affecting in turn the livelihood of 50,000 residents at Hoa Quy, Hoa Hai, Ho Xuan, Hoa Tien, Hoa Khuong, Hoa Phong communes;
- 700,000 people in urban areas will encounter problems in water supply;
- Operation of a significant number of enterprises, trading and service companies will be affected during the dry season; and
- 7 communes with 2,140 households in the West along Tuy Loan and Cu De Rivers with the total area of 50 km^2 will be threatened by flashfloods.

Source: Interview and Report of The Flood Control, Search and Rescue Steering Committee

Coastal erosion

Drought in Danang

Broken roads

change can lead to a disordered state in the society and may even surpass any economic crisis. Thus, it is necessary that Danang undertakes key measures to further strengthen its capacity for disaster risk reduction, response and mitigation.

ICM — A Framework for Sustainable Development

Danang started implementing the integrated coastal management (ICM) program in 2000. After a decade of implementation, Danang serves as a working model for ICM implementation in Vietnam. It is recognized that Danang was instrumental in the issuance of the Prime Minister's Decision 158/2007/QD-TTg, dated 9 October 2007, approving the "Program on ICM for the Northern and Northern Central Coastal Areas of Vietnam up to 2010 and orientation up to 2020." Fourteen out of the twenty-eight coastal provinces under this program are currently at varying levels of ICM implementation following Danang's model.

One of the key outputs of the ICM program is the Coastal Strategy, which serves as an integrative framework for the long-term management of Danang's coastal area and marine environment. The changing conditions in Danang with respect to its increasing vulnerability to natural disasters required adjustments in the Coastal Strategy and its Implementation Plan and its subsequent integration into the socio-development plan of the city.

Danang's response to climate change was carried out based on the principles of sustainable development, integration and a multistakeholder approach, as well as the national government's Strategy for Natural Disasters Preparedness, Response and Mitigation to 2020 and other relevant national programs on climate change. The ICM approach has facilitated the identification of timely interventions on critical issues related to climate change — both at the operational and strategic levels.

Danang has put in place the following measures in response to the challenges of climate change.

Enhancing critical policies and organizational mechanisms

Legislation to reduce and mitigate the impacts of natural disasters have been adapted by the Danang People's Committee in relation to: identifying adaptation measures and planning for high-risk areas that are prone to

flooding and exposure to typhoons; regulating construction works that may cause alteration of water flow and impede drainage capacity; and preservation of natural resources that act as protection against natural disasters.

In support of disaster preparedness and response, responsible units were established at the city (i.e., The Flood Control, Search and Rescue Steering Committee provides policy guidance) and commune levels (i.e., Natural Disaster Prevention Teams mobilize and guide the local residents to implement the directions of the Flood Control, Search and Rescue Steering Committee). Vanguard units were also established with members mainly consisting of volunteer groups from the youth, officers, students and staff of various associations, which help evacuate residents to safe places, and disseminate information on the flooding situation and solutions for typhoon and flood prevention.

Public awareness and enhancement

Integration of relevant information on climate change into public awareness and enhancement programs has been undertaken to increase the level of consciousness of the communities about the risks, and teaching them to act properly to protect themselves and reduce their exposure to hazards. General information on the risks and damages from natural disasters, prevention and mitigation of the impacts; rehabilitation measures for the environment; advantages of improving structural and building safety; understanding of early warning systems, procedures and timely evacuation of affected communities; protecting drinking water sources to ensure the health of the communities; and, most importantly, making use of native knowledge in communicating natural disaster prevention and mitigation.

Box 5. Updating of the coastal use zoning plan.

Danang has identified high risk areas, particularly those affected by flooding and flashfloods, storm surges and erosion. Updating the coastal use zoning plan, which is one of the important outputs of the ICM program, was necessary in order to take into consideration sensitive and high-risk areas that are affected by natural disasters.

The coastal use zoning plan has also identified areas for tourism development. The coastal road (Nguyen That Thanh Road) and riverside road (Bach Dang Road) were rehabilitated not only to improve the capacity of the drainage system of the city but also to improve the landscape to support transportation and tourism development.

More importantly, the communities inhabiting the rehabilitated coastal road and riverside road were relocated into safer apartment buildings that were not very far from where they lived before. Hence, adjustments to the new environment were not a concern.

According to the data from the Department of Construction, Danang moved and resettled more than 70,000 households, approximately 1/3 of the population, during the past 10 years in the urban rehabilitation process.

Coastal roads

According to Dr. Tran Van Quang of Danang Polytechnique University and The Flood Control, Search and Rescue Steering Committee, it is necessary to enhance the adaptation and response capacity of the communities, especially those belonging to the low income class and those inhabiting known risk areas. It is also necessary to identify strategies to protect the water resources and ensure the needs for development (industrial, agriculture, tourism, etc.) and the communities.

Enhancing the green cover

Treeplanting of indigenous tree species has been undertaken. Plans for settlement areas in agricultural lands and mountainous areas were also developed. Communication activities increased and the local communities have also been mobilized to participate in forest protection activities.

Trees that are used for urban greening can also serve as protection against natural disasters. Experience in Danang, however, showed that trees can also pose threats to people and property during typhoons. Regular pruning of big trees is done to reduce the incidence of accidents due to fallen trees. Pruning also protects the trees from being uprooted during typhoons.

Regulations are also passed to prohibit the residents from planting various trees of their preference. Guidelines are provided to the residents on the recommended types of trees as well as planting techniques. For example, several layers of trees are planted along the coast to protect the shoreline from strong winds and storm surges.

Strengthening technical capacity

Strengthening technical capacity and identifying technological options to reduce risks and damage were in the form of:

- Increased investments on equipment and in enhancing its forecasting capacity through utilization of remote sensing images; establishing hydrometeorology monitoring station networks that are capable of forecasting typhoons and floods; and developing software models to predict typhoons.
- Upgrading of engineering and construction works, particularly the drainage system, including options for dredging of channels at the river mouth; construction of dyke systems at critical locations that are prone to erosion; planning and construction of sheltered areas for ships and boats; and providing guidance on building standards and codes.
- Strengthening rescue and communication efforts by acquiring additional equipment to upgrade the existing communication system and facilities. Offshore fishing vessels are also required to install radios and other communication equipment to ensure that they can be notified in the event of typhoons. The city also looks at how mass media can be strengthened to ensure that information dissemination is efficiently and effectively undertaken.

Danang also invested in infrastructure development, such as improving the dike system, building multipurpose

Box 6. The Greening of Danang City.

Under the cooperation framework between PEMSEA and the GEF-UNDP Small Grants Programme, Danang successfully implemented the pilot project on socialization of urban green treeplanting and contributed to increasing the green cover for the city. The project planted more than 17,000 green trees at 23 places in 5 pilot communities through the Association of Natural Resources and Environmental Protection. The Association also received the financial support from some enterprises in the city to plant more then 5,000 trees at six other locations.

shelter houses for typhoons and building shelter areas for ships and boats. According to Mr. Tran Dinh Hong, Deputy Director of the Department of Construction, the Danang People's Committee recognized the urgency to rebuild the houses for the residents after Typhoon Xangsane caused widespread devastation in the city. The Chair of the Danang People's Committee (PC) directed the Department of Construction to explore appropriate design for shelter houses that could withstand typhoons and floods. The engineers of the Department of Planning and Investments successfully designed shelter houses for typhoons that cost less than VND 15 million per house or approximately USD 950 (2008). The design was subsequently approved by the Danang PC and districts. About 200 poor households served as beneficiaries with budget support from the local government.

Box 7. Danang People's Committee adopts DRR guidelines.

According to Mr. Huynh Van Thang, Deputy Director of the Danang Department of Agriculture and Rural Development, applicable methodologies and guidelines to properly respond, prevent and mitigate the impacts of natural disasters were adopted by the Danang People's Committee and implemented by local agencies and the residents. These methodologies were reviewed and validated, and drills were undertaken, including procedures on evacuating residents to safer places in the event of flashfloods and storm surges. Lessons learned from past typhoons have proven to be the best teacher for the communities.

Promoting energy efficient practices

A number of programs on energy conservation were implemented by the local government, such as the use of energy efficient lighting systems and changing or replacing equipment that consumes too much electrical energy. Equipment that uses solar energy and replacing motorbikes using petrol with motorbikes using natural gas is being encouraged and sponsored by the local government. Policies concerning solid waste management and wastewater recycling and reuse were passed and programs on cleaner production were also encouraged.

Moving Forward

The various programs of the local government in adapting and responding to climate change impacts are commendable. However, there are still a number of challenges that need to be addressed and opportunities that Danang needs to consider, including:

- Further strengthening of the multiagency and multisector organizational and coordinating mechanism of the ICM program to include climate change concerns.
- Passing and adoption of relevant policies and guidelines on the approach and method of resilience planning and incorporating climate change into development plans and relevant sectoral programs of the local government, including the mainstreaming of the Danang Climate Change Resilience Action Plan (2011-2020).
- Establishment of a regular mechanism for monitoring, evaluation and reporting of adaptation practices and integrating these into the State of the Coasts reporting for the Danang ICM program.
- Mainstreaming climate change programs into the population and hunger elimination and poverty alleviation programs of the local government.

Box 8. Climate Proofing Measures.

About 24,806 m of the total 58,190 m of Danang's river dikes were assessed to be structurally unstable. By the end of 2008, Danang was able to strengthen 6,500 m of the dike system to serve, in addition to other functions, as barrier for salinity intrusion. According to the Vice Chair of the Hoa Quy commune, Mr. Nguyen Duc Tung Lam, the salinity barrier with a total budget of over VND 9.3 billion or USD 584 million (2008) saved more than 400 ha of agricultural land and doubled the productivity. It is estimated that by 2020, the entire field dike system will be strengthened to withstand typhoons and floods.

In addition, the city developed four multipurpose shelter houses for typhoons and 88 houses were built as model houses to prevent typhoon damage. The City also developed guidelines for the construction of safer houses for the residents following the model houses, which can withstand a wind/typhoon force of over 12. Mr. Nguyen Tam, a farmer in An Luu village, surmised that during the historical floods in 1998–1999, about 97 houses in the village were flooded and the local government rescued about 400 residents from the flooded area, which was 3 km away from the main road. Although no severe flooding has occurred so far, the shelter houses have provided a sense of security for the residents since the urgency to evacuate each time there is flood is no longer necessary.

Dike system to prevent saltwater intrusion.

Multipurpose shelter house for typhoons and floods.

- Strengthening the technical capacity of relevant local authorities in climate change resilience planning, including new approaches and methods in forecasting.
- Promoting opportunities for cooperation and sharing of experiences as a member of the CITYNET, the Asian Cities Climate Change Resilience Network (ACCCRN) and the PEMSEA Network of Local Governments for Sustainable Coastal Development.

References:

Board of Prevention of Flooding and Rescue of Danang City. Yearly reports (2000-2009).

Department of Construction. The report of yearly work for Department of Natural Resources and Environment, Department of Construction (2000-2009).

Department of Natural Resources and Environment of Danang City. Report of the current state of the environment in Danang City in 10 years (1997-2007).

Hydro-Meteorological Centre of Central Region. Data for Hydro-Meterological for every year (2000 - 2009).

Nong Thi Ngoc Minh. 2001. Accomplishment report of the flooding project for Danang City.

Project of socialization of planting in Danang City. 2009. The accomplishment report of the socialization of planting in Danang.

Mobilizing Stakeholder Participation and Ownership through ICM: Lessons from Chonburi, Thailand

By Dr. Praparsiri Kanchanopas-Barnette, Department of Aquatic Science, Faculty of Science, Burapha University, Chonburi, Thailand; Mr. Chatchai Thimkrajang, Sriracha Municipality, Chonburi, Thailand; and Dr. Kashane Chalermwat, Department of Aquatic Science, Faculty of Science, Burapha University, Chonburi, Thailand.

Chonburi province with major highways, railroad and offshore islands.

*Author's email: praparsi@buuac.th.

Chonburi is a coastal province in Thailand, 80 km southeast of Bangkok. Situated along the inner Gulf of Thailand, it has a 160 km-long coastline and is rich in natural resources and well known for its manufacturing industry and tourism. Apart from its industries, the province is the center of marine fisheries and aquaculture in the inner Gulf of Thailand. It has a rapidly growing local and migrant population of 1.3 million living within the confines of its 4,363 km^2 area, considered to be a moderately high population density for a Thai province.

The economic significance of the province is evident through the Thai government's commitment to develop the province's infrastructure from the early 1980s to the present. A major industrial manufacturing center, Chonburi is also a gateway for imports and exports with the Laem Chabang deep sea port. It is a new energy hub for the country. The Eastern Seaboard Project of Thailand is aimed to develop the region as the new economic zone, based on major manufacturing industries, seafood resource and agricultural business. The development envisages distributing economic and industrial growth at the local level.

Since the early stages of its development, the province has been beset by numerous issues related to conflicting use of coastal resources, habitat loss and pollution. Rapid and unregulated coastal development and urbanization over the past 20 years have posed threats to its ecological resources, cultural and

Box 1. Blueing the crab and greening the turtles and mussels.

A "crab condominium" or "crab condo" project was initiated by the Sriracha Municipality to provide a protected temporary refuge for berried blue swimming crabs. The "crab condo" concept is to create public awareness and allow berried female crabs to be able to survive harvest and live to spawn. The berried females are maintained in stacked basket containers ("condos") and are hung in rafts out at sea. This project has been in operation for the past six years in five different municipalities namely: Sriracha; Bang Pra; Laem Chabang; Bang Sare; and Sattahip. In addition, crab juveniles are released into the wild at least twice annually in conjunction with the King's and Queen's birthdays. In 2009, a project for aquatic resource enhancement was established with a goal to release 3 million one-month old crab juveniles. The project received a budget of Baht 500,000 (fiscal year 2009–2010) and the nine locations for release were in Muang Chonburi district to Sattahip. At each location, the local community played a significant role in organization of crab release details, as well as the monitoring of crab resources utilization. Water quality checks were frequently made and plans were made to attempt to measure the impacts of the crab release on crab landing statistics. Because of the high levels of interest and publicity from such projects, an integration of climate change knowledge into such programs can be readily made to promote awareness and understanding of the phenomenon.

Promotion activities for the "crab condominium" project in Sriracha municipality.

Sea Turtle Conservation

A sea turtle conservation program is being implemented in close cooperation with the sea turtle conservation center of the Royal Thai Navy, wherein sea turtles are released annually to their natural habitat with wide public participation. Under this program, the local municipality and the Royal Thai Navy have taken an active role in sea turtle conservation. They set up a sea turtle hatchery and encouraged local fishers to rescue sea turtles caught by fishing nets, providing collection ponds in the city park where the turtles are fed and treated for wounds and diseases. Turtles from the hatchery and from the parks are then released back to the wild. The annual release of sea turtles has been designed to enhance stakeholder awareness and participation in coastal resource conservation, attracting the participation of local fishers and citizens, the private sector, academe, government agencies and administrative units, as well as the media.

The former Mayor of Sriracha Municipality, Mr. Chatchai Thimkrajang, receiving municipal guests interested in the innovative mussel farming practices of Sriracha Bay.

Eco-friendly Mussel Farming

Innovative mussel farming systems have also been developed along the coast. Floating mussel farms are a new method of raising green mussels in Sriracha Bay. This method has resulted in additional income generation for fishers and aquaculturists in the area. The farmers utilizing this method have formed an association with technical assistance on the biology and ecology of green mussels from government institutions and universities in the area. Since 2004, Kasetsart and Burapha Universities have assisted the association members in studies relating to growth and mortality of green mussels. The Sriracha municipality granted Baht 200,000 in 2007 to Burapha University to study the epidemiology of mussel mass mortalities reported in the area. It was later found that there had been occasional outbreaks of predatory and parasitic flatworms. Such outbreaks have been scientifically linked to climate change and global warming.

Sea turtle release activities co-sponsored by the Royal Thai Navy, universities and municipalities.

traditional heritage, social security, economic growth and overall quality of life.

Because socioeconomic activities in the coastal areas are conventionally managed by different line agencies, many institutions are directly or indirectly involved with coastal and marine governance. Therefore, a natural resource and environmental management system, which employs an integrative, holistic approach leading to interactive policy making, planning and implementation is needed to integrate and coordinate coastal management. This ensures that the management strategies formulated are responsive to collective ecological, social and economic issues. This optimizes the utilization of coastal resources.

In August 2001, the Chonburi provincial government, in collaboration with PEMSEA, initiated development and implementation of an integrated coastal management (ICM) demonstration project. This led to the adoption of ICM concepts in policymaking and management. ICM ensures that coastal management efforts of the various stakeholders do not conflict with one another and are not duplicated.

Starting from a demonstration area covering five municipalities — comprising18 percent of the provincial coastline — and through consistent awareness and capacity building and visits to other ICM sites, ICM implementation in Chonburi has scaled up over the recent years. By the late 2008, all 26 coastal local governments had become part of the Chonburi ICM Network. Eventually, in 2010 the Network expanded to cover the entire province, or a total of 99 local governments.

Chonburi today stands at a crossroad after 10 years of ICM implementation. It is the most opportune time to evaluate the lessons learned in the implementation and scaling up of ICM and relate these to emerging issues which Chonburi faces, including climate change and the associated risks and impacts.

Scaling up ICM increases interactions and strengthens relationships of various stakeholders — resulting in increased, lasting trust

The Chonburi Coastal Strategy serves as an integrated plan for activities contributing towards sustainable development of the province. The implementation plan of the Coastal Strategy (or the CSIP) provides a basis for the development of annual municipal development plans; the allocation of local budgets; and the identification of roles and responsibilities of various stakeholders. The CSIP review and planning process is undertaken annually in Chonburi as part of the planning for the next fiscal year. This ensures that ICM implementation is in-line with the national strategy for marine and coastal management and the provincial plan, and addresses key local issues. It also ensures the availability of funds to support the ICM program, and identifies areas needing support from various partners.

To implement the identified ICM activities, a high-level multiagency and multisectoral Provincial ICM Coordinating Committee has been in operation since 2006. Headed by the Vice Governor (and recently by the Governor) of Chonburi province, it provides guidance to ICM implementation and facilitates interagency and cross-sectoral collaboration. An ICM Program Management Office (PMO) is responsible for coordinating implementation of the ICM program. Headed by an ICM Program Director, it consists of a local government consultative board, four divisions responsible for planning, financial management, communication, and information, and a secretariat for day-to-day operations. The local government consultative board is composed of mayors or heads of local governments, where an ICM Director is elected every two years. The board also agrees on the assignment of local governments in the various divisions under the PMO. The ICM Secretariat was located in Sriracha Municipality, until it was transferred this year to the Chonburi Provincial Administrative Organization in response to the scaling up of ICM implementation to the entire province. In accordance with provincial policies, the monitoring and evaluation of participation by the various municipalities was a high priority.

In March 2011, all 99 local governments of the Chonburi ICM network initiated the development of ICM plans for consolidation into the updated Coastal Strategy Implementation Plan (CSIP) for years 2012–2014 and integration into their respective municipal development plans and the provincial development plan.

It is very apparent that the Chonburi ICM program has progressively gained buy-in across the whole province. The scaling up has been clearly grounded on three principles:

1. ***Fidelity to context.*** The problems in Chonburi are highly context-specific because they are driven by physical, environmental, economic, social, cultural, institution and governance dimensions that are nuanced particularly to the province. As well, these issues are seen as very dynamic and perpetually changing. Hence an "organic" or constantly evolving, revised and maturing Coastal Strategy for the province and its action plans are being tailored to local conditions, experiences and knowledge. Most importantly, they were tabled during regular meetings and during planning and decisionmaking processes.

   The Chonburi initial risk assessment (IRA) identified priority environmental issues of concern in the area, as well as the technical gaps present. The results of the IRA have been used as inputs to the development of programs and the setting of priorities for implementation. Management-oriented social and scientific research has also been undertaken to address specific coastal management and risk issues.

Box 2. Habitat restoration, resource protection and management.

The development of the Chonburi coastal area is a continuing process, which has entailed land reclamation and the resulting destruction and loss of mangroves. Four decades ago, the mangrove forests in Muang Chonburi district covered an area of about 8,000 km^2. Development along the coast and subsequent deforestation left only 960 km^2 from 1977. The coral reefs in the area are also under threat, especially in years with recorded drought and high temperatures. The reef losses have not been valued due to lack of an evaluation system. To compound problems, land use conflicts exist between residents and areas designated as protected.

Eventually, communities realized the value of mangrove forests for fisheries productivity and storm and tidal surge protection. A mangrove conservation and restoration program was initiated, with active replanting of mangrove trees by communities along the coastline. Programs for the restoration of mangrove forests have been conducted by the Chai Thale community of Muang Chonburi Municipality, Ban Thai Community of Ang-sila Municipality, and Khao Sam Muk Community of Saensuk Municipality. Numerous conservation projects provide activities for the youth, such as educational field trips and mangrove planting excursions. The youth share their experiences with other communities. Again, knowledge on climate change has been integrated into all local government programs related to school activities.

Cooperation of the community and government officials in mangrove replanting programs along the coast of Chonburi.

Seagrass planting activity participated by local government, municipal schools and communities in Sriracha Municipality.

Seagrass planting has always been a popular activity for school children. A project for restoration and transplantation of seagrass in Sriracha Bay has been conducted for several years. The project successfully transplanted seagrasses from Kung Kraben Bay in Chantaburi province to Sriracha Bay near Koh Loi district, with a present day survival rate of 26 percent. Accompanying scientific studies demonstrated the significance of sediment quality for seagrass survival. The project has also served as a demonstration project to enhance public awareness on the value of seagrass beds and promote public participation. The seagrass transplantation activity has involved technical staff from Kasetsart University, staff from Sriracha Municipality and municipal schools, as well as local fishers and fishing communities.

2. ***On linking with the development processes.*** The ICM program, as a natural resource and environmental management system for Chonburi, is viewed from a planning and development perspective. As an inclusive and collaborative approach, it facilitates coherence among municipalities while complementing those espoused by national, regional and provincial (and even international) policies.

3. ***Integration among stakeholders.*** Before ICM was adopted, there was no mechanism for multisectoral consultation and decisionmaking. Local government leaders made decisions for their own respective areas. As a consequence, limited resources were being allocated for coastal management. For example, prior to the adoption of the ICM program in Chonburi, a local communication plan for fisheries and natural resources was already available. This eventually led to a Provincial Development Plan integrating public education and awareness solely focused on fisheries and aquaculture. Presently, the majority of the development plans of the local government units (LGUs) integrate public education and awareness on natural resources and environment.

Scaling up ICM ensures integrative collaborative governance — it broadens perspectives for innovative interventions

The implementation of ICM in Chonburi, especially in Sriracha Bay, has focused on the protection and rehabilitation of natural resources and the marine environment. The municipalities involved have worked in close cooperation with relevant authorities, state enterprises, the private sector, the community in general, and educational institutions. The coastal communities have received support in terms of information and knowledge, materials, equipment and cooperative implementation of approved projects. Capacity development and knowledge-sharing activities have included training workshops and consultations, public awareness and stakeholder mobilization. Numerous scientific studies dealing with the protection and rehabilitation of coastal and marine resources and improving wastewater management have also been initiated.

The adoption and implementation of the Chonburi CSIP, which requires local governments to allocate budgets for specified activities, ensures the long-term financial sustainability of ICM implementation in Chonburi. Annual allocations have been provided since 2006. The CSIP is also used as a basis for requesting central government funds for various coastal management activities. A budget for capacity building is usually allocated by each participating local government as indicated in the CSIP.

Box 3. Water use and supply management.

Chonburi historically has had shortages of freshwater due to overuse of available resources in reservoirs. Presently, water is piped in from reservoirs in Rayong province. As of 2009, 742 artesian wells were operated by the private sector and an additional 1,536 wells by government agencies. Nevertheless, there are still severe shortages. Droughts occur frequently even in relatively high rainfall years and the rate of water receding in the reservoirs has been alarming. Programs to monitor water levels for rivers, reservoirs and wells were implemented. Most importantly, the municipalities instituted mechanisms to stop leakages in water distribution systems and improve water quality for human consumption (e.g., reverse osmosis facilities have been installed to remove fluoride and iron from the water supply).

The water management plan in Chonburi emphasizes suitable and equitable water allocation for all water use sectors. The implementation of the national decentralization policy that delegated greater water resources management authority to local governments has enhanced the implementation of public awareness activities during national and religious holidays with the participation of stakeholders. In addition, policymakers are now focusing on regulatory measures, such as the polluter-pays principle, and considering methods of achieving better wastewater handling protocols. Attention is also being paid to reuse treated wastewater. Water resources management in Chonburi for sustainable development has been strengthened based on the goals set by local governments, especially through ICM implementation, in conjunction with the participation of the stakeholders and the multisector users.

Proposed water conservation projects in preparation for potential shortages in the future due to climate change were included in the development of water catchment areas, the digging of irrigation canals, as well as the development of plans for water resources utilization. Contingency plans were developed for flood and drought prevention at the local community level with integration into larger provincial and regional flood and drought projects.

Reuse of treated wastewater in some municipalities is also being practiced. Such projects reuse treated wastewater from the municipal wastewater treatment plants for utilization in watering municipal parks and the sides of highways.

Box 4. Solid waste management.

Garbage bank projects have been established in many municipalities, organized by local communities with support from the municipal office. The programs serve to reduce the volume of municipal and household solid wastes before being transported to disposal sites. The garbage is separated into different streams; some are reused and others are recycled. There are two primary locations for separation activities, separation at the community level and separation in schools.

Volume reduction in solid wastes from 2008 stemming from the establishment of a garbage bank has resulted in a reduction of solid wastes that would have ended up in landfills. An example is at Sriracha Municipality where Mr. Chumrueng Attanat along with 15 volunteers provided data that the municipality separated 385 tons, from a disposal rate of 35 tons per day, of paper, plastic, and glass bottles in a 75-day experiment. They were able to separate recycled materials of approximately 10.6 tons yielding a net income of approximately Baht 18,000. This is equivalent to 2.76 percent of daily garbage load in Chonburi province. In Chonburi province, there are 20 community garbage banks plus an additional 200 locations in schools.

Community solid waste separation site in Sriracha municipality.

Local governments are also working closely with universities in the area (e.g., Burapha University, Fisheries Research Station of Kasetsart University and Aquatic Resource Research Institute of Chulalongkorn University) to address various technical information needs to enhance decisionmaking (e.g., technical study on the impacts of sea-based transfer of cassava flour and other dusty commodities in Sriracha Bay; research to address sea turtle diseases in the conservation ponds; green mussel diseases; seagrass transplantation; oil spill impacts; ocean circulation; etc.). Numerous university faculty and staff are already involved in climate change research. These personnel serve as facilitators for the expansion of climate change knowledge and know-how for the local governments.

Several universities and research institutions are found in Chonburi namely, the Sriracha Fisheries Research Station of Kasetsart University and Kasetsart University, Sriracha Campus; Department of Aquatic Science (Faculty of Science), and Marine Science Institute, Burapha University; Rajamangala University of Technology, Eastern Region; Thamasart University; and Aquatic Resources Research Institute, Chulalongkorn University. These universities also have their own funds to complement municipal initiatives in ICM.

Such mechanisms have greatly benefited from the integrative platforms (i.e., coordinating mechanisms, planning processes, legislation, communication plans, etc.) which the ICM program put in place. Scaling up activities have also strengthened collaborative governance. All of which have led to at least three realizations, as follows:

1. ***Widening the policy and implementation spaces.*** The very complex problems in Chonburi are the very impetus to requiring a broader, more comprehensive, and more inclusive framework where the local governments, NGOs, business, universities and other stakeholders operate. This is to accommodate the many and varied perspectives (and scientific information) needed to evaluate alternatives and ways to successfully implement interventions. It all boils down to increasing the implementation space where problems are analyzed and solved, and solutions shared.

In accordance with an agreement reached through the Project Coordinating Committee (PCC), all participating local governments are also required to allocate Baht 50,000 each to support the operations of the Chonburi ICM Secretariat in Sriracha Municipality. The involvement of Pattaya City and the Chonburi provincial administrative organization in the Chonburi ICM network, which have sizeable budgets, also provides a potential source of financial assistance for some financially-constrained municipalities.

Chonburi is also receiving financial assistance from the GEF-UNDP Small Grants Programme (SGP), as part of the SGP-PEMSEA Joint Communiqué. An SGP project developed with the support of PEMSEA, which includes mangrove reforestation, expansion of the "crab condominium" (**Box 1**), and community-based waste management, was completed in 2010. Although systematic studies on harvest and income have not

been conducted, local fishers have noted improvements in the catch of crabs and other fish species. Two other SGP projects were initiated in 2011 covering 9 communities in 7 municipalities to scale up community-based waste management.

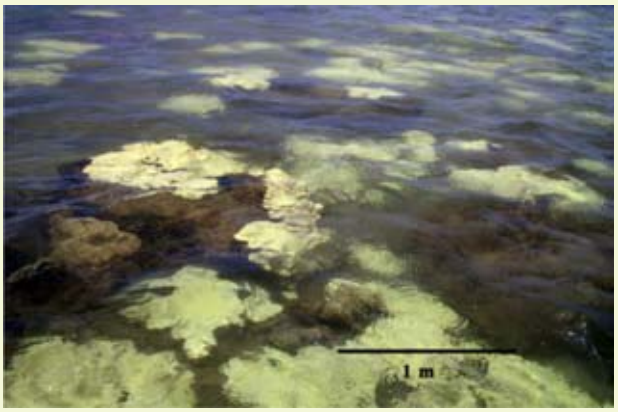
The private/commercial/industrial sector has also been supportive of the program, contributing to various activities. For example, Sriracha Municipality has signed a Memorandum of Understanding (MOU) with Underwater World Pattaya for cooperation in sea turtle conservation.

2. ***When there is a crisis in Chonburi, it is within their capacity to resolve it.*** Because all local issues are public concerns, people are willing to participate in ICM activities. Increasing participation in coastal management activities — in issues that concern habitat restoration, resource protection and management (**Box 2**), water use and supply management (**Box 3**) and waste management (**Box 4**) — has consistently been observed. People actually participate in events and activities at their own cost (e.g., transportation, food) as they view ICM activities as opportunities for learning, sharing experiences, and social growth. Scaling up ICM activities has actually empowered "public coalitions" in addressing problems. In essence, solutions are forthcoming when enough political will and social support are likewise strong.

Box 5. What is climate change doing to the coastal areas of Chonburi Province?

Coral reef bleaching and ocean acidification

The first report on the mass bleaching of soft coral reef colonies in Chonburi occurred in October 2006. Almost 95 percent of all visible soft coral colonies were completely bleached, especially coral at depths of 1-2 m below mean sea level. During the periods of bleaching, the highest ambient seawater temperature in the area was 33.78°C and the highest salinity was 33 psu (practical salinity unit). Under normal conditions, the temperature and salinity in the area should average 28°C and 30–31 psu, respectively. This incidence could be related to climate change and global warming. Corals have been shown to bleach through the combined effects of elevated sea temperature and high solar radiation. Elevated levels of carbon dioxide may lower the pH of seawater resulting in harmful effects on marine organisms, especially those with shells or exoskeletons made of calcium carbonate.



Mass bleaching of shallow soft coral reef, *Sarcophyton spp.* colonies at Sattahip coast (Courtesy of Suchana Chavanich).

Mass mortalities of venus clams along the coast of Chonburi in 2005

Increase in the incidence of disease in marine organisms

Venus clams are abundant along the coast of Chonburi. In March 2009, massive mortalities were reported along the coast of Bang Phra district. An earlier mass mortality had also been reported along the beaches of Sri Chang Island off the coast of Sriracha in 2005. It was noted that the mass mortalities occurred during the summer months of March and April when seawater temperatures were between 33-35°C. Salinities were also between 33-35 psu. Seawater temperatures and salinities recorded since 2007 have been about 2 psu and 2°C higher than in previous years. These elevations may have resulted in disease and parasites proliferating in the bivalves.

Outbreaks of parasitic and predatory flatworms that can infest mussel farms have caused increased mortality for green mussels from raft-grown mussels. Severe mortality in mussel farms has been attributed from infection of at least two species of flatworms. The recent spread of flatworms seems to be correlated with increases in seawater salinity due to decreased rainfall. Damage from flatworm invasion has resulted in a 20 percent decrease in farmer income concurrent with a 30 percent decrease in mussel output.

Continued in page 21...

3. ***Higher benefits compared to cost.*** ICM scaling up is contributing significantly to the building of local capacity to address various challenges to sustainable coastal development though contributions from various stakeholder groups, including: (1) local governments (e.g., increased allocation for marine and coastal management; support for the ICM Secretariat; human resources; use of facilities; etc.); (2) government agencies (e.g., financial contribution of the Wastewater Management Authority to support school essay writing contests, sea turtle release and other public education and mobilization activities, and crab conservation; use of the boats of the Royal Thai Navy and Royal Thai Police for various activities including the sea turtle release program; technical support from the Marine Department and Pollution Control Department in developing the local oil spill contingency plan for Chonburi; etc); (3) private sector (e.g., good source of knowledge on climate change and global warming and its potential impacts on coastal communities; contribution of the Restaurant Association through installation and promotion of grease traps in restaurants; financial contributions from oil companies (i.e., Thai Oil; Esso Thailand; PTT) for crab conservation, tourism promotion, public health park, marine environmental learning center, and demonstration of oil spill clean up techniques); (4) local schools/ universities (e.g., financial contribution of Duangmanee School for crab conservation; mobilization of local school administrators and personnel to set up and operate 'Garbage Banks' in schools; use of the equipment and facilities of the Kasetsart University and Burapha University for various activities); and (5) fishers and communities (e.g., contribution of the Fisherman's Association in maintaining the Crab Condos; participation in various ICM activities).

   The additional investments by the stakeholders are considered to be worthwhile and will lead to greater benefits. The distribution of the benefits and costs associated with ICM implementation depends on the extent of implementation of the CSIP of each participating local government.

Scaling up ICM institutionalizes a mechanism to drive sequential attention to developmental risks and opportunities.

ICM programs are never short-term engagements. They are long-term; even life-long. As exemplified by Chonburi, over the years the issues have ranged and shifted from marine pollution to environmental protection to conservation of key species. Several approaches have also become evident and evolved: from adaptive and ecosystem-based management to an emphasis on sustainable livelihood approaches. The recent attention to vulnerability and resilience is an outcome of the threat of the increasing frequency and magnitude of natural and manmade disasters.

ICM as an approach has matured over the years and now looks at integrative, collaborative governance to encompass all risks; be they climate or non-climate stressors.

Chonburi is showing at least two learnings:

1. ***Adaptation to coastal risks is an ongoing process.*** Chonburi is now cognizant of the fact that adaptation to climate and non-climate stressors is a process of coping that shifts. It ranges from addressing current realities and environmental emergencies to anticipation of future risks. It involves learning of changing scenarios and constantly shifting development pressures and opportunities.

   Recent studies conducted in Chonburi have shown correlation of environmental emergencies to changing climate (**Box 5**). The link between ecological degradation, caused by man's activities, and the increasing vulnerability to and impacts of natural hazards and climate change is increasingly being validated. Coastal habitats are being lost and converted to accommodate settlements and other land uses. Not only is Chonburi losing its natural protection from natural hazards, human impacts on ocean ecosystems, such as mangroves and seagrass beds, have significantly reduced the capacity of these ecosystems to sequester carbon from the atmosphere.

   ICM provides a framework and process that "covers" climate change adaptation. That is, there is no need to establish a separate mechanism to address climate change; climate change adaptations can build on the existing ICM mechanism.

2. ***There is value in sequential attention to developmental risks and opportunities.*** As a long-term endeavour, ICM is based upon the need to structure the distant goals of sustainable forms of government into stages; starting the "harvest of the low hanging fruit" and leveraging initial successes into the next step. Scaling up is a pragmatic mechanism, which utilizes the strong fundamentals that have been initially created in the development of ICM programs; lessons abound from these initial experiences.

Conclusion

ICM implementation in Chonburi has established a mechanism whereby local governments and various stakeholders collaborate to solve common problems. Solutions have involved significant commitments by participating local governments and sectors, in terms of political, technical and financial support. As ICM is a continuing and iterative process, commitment and support should continue to grow, along with awareness and capacity, to deal with current and emerging concerns including climate change, utilizing existing multistakeholder processes and building on lessons learned in the past ten years.

Box 5. What is climate change doing to the coastal areas of Chonburi Province? (continued from page 19)

Impacts on coastal aquaculture

For the past 18 years or so there have been shellfish mass mortalities attributed to increased rainfall (flushing) and prolonged salinity declines along the Chonburi coast. The production of green mussel (*Perna viridis*) along the northern Chonburi coast, which is under influence of riverine discharge from the Bangpakong River, declined to 40 percent and 10 percent in 2008 and 2009, respectively. Rising temperatures have caused an increase of water evaporation impacting on coastal land-based aquaculture. Operators of these land-based farms have had to frequently top up their ponds to desired water levels.

Reduction of freshwater supply

The estimated freshwater demand in Chonburi is 186 million m^3 for agriculture, industry, tourism, ecological conservation and domestic use. There has been a serious decrease in water supply from the nine freshwater reservoirs in Chonburi since 2004. In 1995, only 20 privately operated underground water wells were permitted. This number has increased to 100 and 700 wells in 2004 and 2008, respectively. In 2009, the number of government constructed wells was 1,450.

Elevated earth surface temperatures are believed to change evaporation regimes of both surface and ground water resources. Changes in rainfall patterns may be responsible for drastic changes in the distribution of freshwater. Droughts may occur in one area, while floods may occur in others. Severe droughts were reported in Chonburi in 2004–2005. Since then the prevailing weather has been characterized by decreased rainfall leading to water shortages, as reflected in reservoir levels. Climate changes may have significant affects on the annual monsoon periods, especially the winter (northeast) monsoons. In Thailand, the summer monsoon rainfall recorded in September has been decreasing for the past 50 years.

Elevated rate of coastal erosion

Coastal erosion especially in the inner Gulf of Thailand and Chonburi is a result of both wind and wave action and anthropogenic activities such as coastal construction and sand mining. There are eight municipalities in Chonburi with problems of coastal erosion (erosion rate can be up to 3-5 meters/year in some areas) namely, Klongtamru, Laem Chabang, Banglamung, Na Chom Tien, Bangsaray, Sattahip, Plutaleung and Samaesan.

Land subsidence

Land subsidence, due to increasing groundwater extraction as a result of freshwater shortages, is on the increase. The increasing number of coastal wells dug since 2004 has further compounded the situation.

Areas under risk, especially from flashfloods, mudslides and storms

Areas under threat from flashfloods and mudslides due to increased severity of coastal storms are found in Sriracha and Sattahip municipalities, as well as in Pattaya City. For example, flashfloods occurred in October 2009 in Sriracha and Pattaya, where up to 1,389 households were affected. Rice fields were damaged over a wide area, and losses of livestock seriously affected the impacted communities. Transportation was disrupted along the major highways as well as many country roads from flooding and from the loss of bridges.

References:

Barnette, P., Tuntiwaranuruk, C., and Thimkrajang, C. 2009. "Growth of and threats to green mussels (*Perna viridis Linnaeus*) in Sriracha Bay, Chonburi, Thailand in relation to pathogenic organisms and water quality factors." Paper presented at the annual meeting of the International Marine Conservation Congress, George Madison University, Fairfax, Virginia. 2012-06-21 from www.allacademic.com/meta/p296285_index.html.

Bensted-Smith, R. and Kirkman, H. 2010. Comparison of Approaches to Management of Large Marine Areas. Fauna and Flora International, Cambridge, UK and Conservation International, Arlington, Virginia, USA. 146 pp.

Khunplome V. and Wiwekwin, N. 2008. "Utilizing ICM to address food security and improve livelihood of communities in Chonburi." *Tropical Coasts*, Vol. 15, No. 2, December 2008, pp. 30-37.

Narcise, C.I. and Sujarae, A. 2004. "Managing environmental risks and developing common Framework of Actions in the Chonburi coastal area, Thailand." *Tropical Coasts*, Vol. 11, No. 2, December 2004, pp. 30-37.

PEMSEA. 2007. Chonburi Terminal Evaluation Report. Global Environment Facility (GEF)/United Nations Development Programme (UNDP)/ International Maritime Organization (IMO) Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) (unpublished).

PEMSEA. 2004. Chonburi Initial Risk Assessment. PEMSEA Technical Information Report No. 2004/02, 128 pp. GEF/UNDP/IMO PEMSEA, Quezon City, Philippines.

PEMSEA and Chonburi ICM PMO. 2004. The coastal Strategy for the Chonburi ICM Project Area. Project Management Office, National ICM Demostration Project in Chonburi, Thailand and GEF/UNDP/IMO PEMSEA, Quezon City, Philippines.

State of the Coasts of Chonburi Province (Draft for publication).

UNDP GEF Small Grants Programme. Project on Marine Resource Conservation, Habitat Rehabilitation, and Waste Management in Chonburi, Thailand. http://sgp.undp.org/index.php?option=com_sgpprojects&view=projectdetail&id=11369&Itemid=205#.UFKLB7JmJK- (accessed May 2012) .

Greening Ports: Bangkok Port's Experience and Achievements

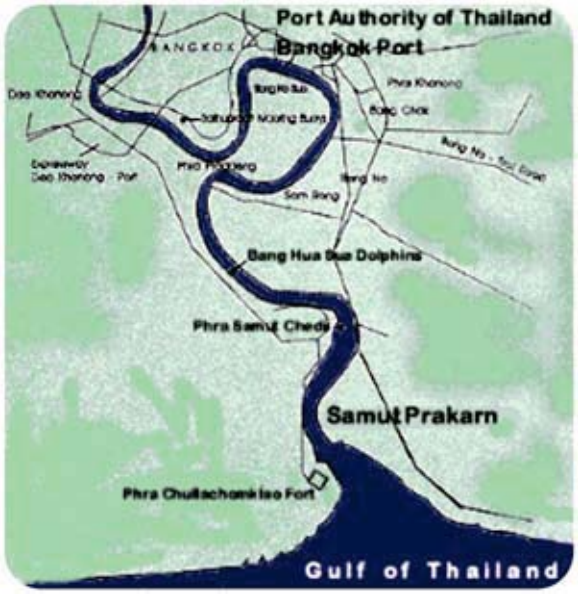
By Aunporn Poopetch, General Administrative Officer 12,
Bangkok Port, Thailand

Introduction

Bangkok Port is one of the three ports that have attained Port, Safety, Health and Environmental Management System (PSHEMS) Recognition from PEMSEA. Its experience in the development and implementation of its PSHEMS resulted in concrete benefits and provided valuable lessons learned. Starting with the handling of its Dangerous Goods (DG), the port has exhibited remarkable willingness to improve the management of its core business processes, demonstrating that efforts to improve safety, health and environment (SHE) governance contribute to the triple bottom line of economic gain, social benefit and environmental preservation.

Bangkok Port's experience in DG handling is a showcase of a concerted team effort leading to inspiring outcomes. In spite of limited resources, Bangkok Port's DG handling has radically improved after the implementation of the PSHEMS. Records on the number of incidents related to DG handling went from a worrisome quantity to an almost nil figure. At the same time, perhaps as a result of enhanced reputation, Bangkok Port's general cargo handling has likewise improved. The volume of cargoes it was able to handle increased from 1.345 million TEU in 2004 to 1.449 million TEU in 2011. More importantly, Bangkok Port's PSHEMS experience has demonstrated that with the proper training and with the support of top management, it can do so much more in managing its operations, controlling its environmental impact and safeguarding the health and safety of its workers.

Bangkok Port personnel in action.



The PSHEMS initiative has sown seeds of continual improvement in Bangkok Port. They only need to be cultivated and nurtured to ensure that Bangkok Port will continue to derive more economic, social and environmental benefits from these undertakings. Back in 2009, then Deputy Director General of the Port Authority of Thailand (PAT) and now Managing Director of Bangkok Port, Sub Lt. Viroj Chongchansittho R.T.N. remarked that "Sustainable port development, including environmental dimension, is crucial to long term growth. The integrated implementation will generate chain reaction benefits for port stakeholders, happiness for port staff, increasing efficiency, reduced operation costs, higher income and reduced accidents, etc." Although these benefits are hard to quantify, and some of which can also be attributed to factors other than PSHEMS implementation, it is nonetheless a safe assertion that Bangkok Port's much better conditions after the implementation of PSHEMS has shown that indeed Green Ports are the gateway to a blue economy.

Background

Bangkok Port is one of the five main ports in Thailand. It is located on the east side of the Chao Phraya River in Klongtoey District, Bangkok, which is under the jurisdiction of the PAT. Bangkok Port is a river port, positioned as Thailand's second largest port with a throughput of 1.449 million TEU in 2011. It has a total land area (within the customs fence) of about 145.36 ha.

Bangkok Port offers cargo services to promote and facilitate international transportation. The services of Bangkok Port include container storage and inbound cargo service, outbound container freight station service, open stuffing area, empty container yard service, reefer container service and coastal and barge terminal.

Explosion in the DG Warehouse: The Abrupt Awakening

In March 1991, an explosion caused by an unidentified chemical occurred in the dangerous cargo warehouse of Bangkok Port. The accident caused losses of life, cargo, property and damage to the environment was estimated at US$ 8 million. The fire started in a warehouse for hazardous substances and spread rapidly via several large explosions. The unfortunate incident prompted the PAT to review safety, health and environmental issues in managing its port operations. Since then, setting up of a new safety, health and environmental management system has been given top priority prompting Bangkok Port to step up its efforts towards improving its SHE governance.

Explosion in Dangerous Cargoes warehouse prompted the prioritization of safety, health and environmental concerns in Bangkok Port.

In March 2005, PEMSEA introduced the PSHEMS to the PAT, who in turn decided to implement the PSHEMS in Bangkok Port. The PAT recognized that PSHEMS is an integrated management system designed to provide port authorities or individual port operators with a management framework for enhancing efficiency, cost-effectiveness and profit for their operations.

PSHEMS Development

Organizing for the PSHEMS: The First Steps

Not surprisingly, the initial scope of PSHEMS development and implementation in Bangkok Port was limited to DG handling since this is one of the core processes in port operations with the highest threat on safety, health and environment. Bangkok Port also took into consideration the availability of resources, manpower and time constraints in determining the scope of the PSHEMS. Later on, with the initial progress it has achieved in DG handling, the scope was broadened to include all other services in the organization (See **Table 1**).

To pursue the development of PSHEMS, certain milestone activities had to be undertaken, foremost of which is securing top management support. Fortunately, in the case of Bangkok Port, top management support and commitment were clearly evident and unwavering right from the start. Top management provided the overall direction in PSHEMS Development and Implementation and gave the organization not only a compelling vision but also a clear path towards achieving the targets it has set for Bangkok Port.

While the scope was limited to DG handling, the development and implementation of PSHEMS has broader strategic objectives. It was also the intention of top management to increase the competitiveness of Bangkok Port, enhance its reputation not just in Thailand but also globally, improve its environmental stewardship and enhance its capability in managing port operations. Within the ambit of these overall goals and objectives, top management eagerly ventured into key activities deemed to facilitate the development and implementation of PSHEMS.

Legal Compliance: Knowing is Half the Battle

As an initial desk review activity, the safe handling and transport of dangerous goods in Bangkok Port was related to the International Maritime Dangerous Goods (IMDG) Code and Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas. In developing the PSHEMS of Bangkok Port, the specific provisions of these international instruments were reviewed and applicable provisions were identified. An action plan was developed to address the gaps in the implementation of relevant and applicable provisions of these instruments.

The PSHEMS Working Group: Great Things Start from Small Beginnings

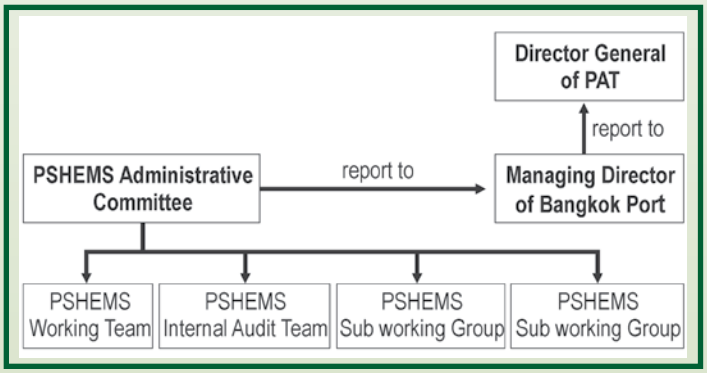
To be able to effectively control and monitor the PSHEMS development and implementation activities, an Administrative Committee (AC) was established and was headed by no less than the Managing Director of Bangkok Port. To support the AC, a working team composed of representatives from all concerned units was established. This working team was further sub-divided into three groups: operational group, equipment handling group and administrative group. Each group was assigned a certain process to meet PSHEM Code requirements. Bangkok Port also provided a working area to serve as a meeting room for PSHEMS-related activities. Apart from the working team, an internal Audit team was also established and was given adequate training. The Audit Team was responsible for the monitoring, control and improvement of the PSHEMS. The organizational chart (**Figure 1**) summarizes the working dynamics of the various entities created for the development and implementation of the PSHEMS.

The aforementioned administrative arrangements facilitated the establishment of the PSHEMS in Bangkok Port. The emphasis on involving all units concerned has encouraged not just support from the bottom ranks but has also effectively engaged key personnel in the planning stages of PSHEMS development. This approach ensured that the processes that would be eventually documented, standardized and monitored are driven by the real process owners and other key contributors in the process areas.

Table 1. Scope of Bangkok Port's PSHEMS.

Scope of Bangkok Port PSHEMS recognized by PEMSEA	Effective Years of Coverage
Service for Handling of Dangerous Cargo	December 2006-2009 November 2009-2012
All Services of Bangkok Port	August 2011-2014

Figure 1. Structure of the PSHEMS Working Group.



Building Capacity: Trainings and More

With technical assistance from PEMSEA, several trainings were provided to the personnel of Bangkok Port to equip them with the right tools and materials in the development and implementation of the PSHEMS. The first training given to port personnel was on "Applicable International Regulations Concerning Port Operation and PSHEMS Design and Implementation." This training covered the major international regulations on port operations such as the Recommendation on the Safe Transport of Dangerous Goods and Related Activities in the Port Area (IMO 1995), SOLAS Chapter VI and VII (IMO 1992), Code of Practice of the Safe Loading and Unloading of Bulk Carriers (IMO 1998), APELL for Port Areas (IMO/UNEP 1996) and Guidance Concerning Chemical Safety in Port Areas (OECD, 1996). The training facilitated the identification of international and national regulations relevant to Bangkok Port's operations.

In addition to increasing the awareness of the project team on the relevant regulations, practical exercises enhanced their auditing skills and enabled them to assess the strengths and weaknesses in port operations and identify areas for improvement.

The result of the audit exercises were used as baseline information for PSHEMS development in Bangkok Port. All in all, Bangkok Port personnel had to undergo several training workshops, that have been put together and tailor-fitted to the needs of Bangkok Port by PEMSEA. The series of trainings followed a step-by-step approach, as follows:

- **Phase 1:** Initial Status Review
- **Phase 2:** Strategic Planning
- **Phase 3:** System Design, Development and Documentation
- **Phase 4:** Implementation, Monitoring, Measuring and Auditing the PSHEMS
- **Phase 5:** Continual Improvement

PSHEMS Documentation: No Pain, No Gain

The development of the management system and documentation of the PSHEMS manual was a challenging task for Bangkok Port. Guided by the trainings and with a ready access to PEMSEA's technical assistance, the following steps were undertaken to ensure proper documentation and to control this process:

- **Step 1:** Review documentation for functional adequacy.
- **Step 2:** Review documentation for compliance with ISO 9001, ISO 14001, OHSAS 18001 and PSHEMS Code.
- **Step 3:** Revise if necessary to correct any inadequacies.
- **Step 4:** Test procedure in operation.
- **Step 5:** Make any final adjustments and implement controlled copy.
- **Step 6:** Update PSHEMS Main manual and Process manual accordingly.

PSHEMS Implementation

Safety, Health and Environment (SHE) programs

During the course of the PSHEMS implementation, various SHE programs were implemented to address identified safety hazards and environmental aspects with significant risks.

Traffic Management

Traffic congestion in and around Bangkok Port has been creating significant environmental and social problems, including air pollution, dust, noise, and

Table 2. Bangkok Port's Traffic Management Measures.

Short-term measures (to be undertaken within a one-year period)	Medium-term measures (to be delivered within 36 months)	Long-term measures (Complex and could take up to ten years or longer to deliver)
• Appointment of a Port Traffic Management Officer	• Establishment of a Port Park and Ride scheme	• Undertaking of Master Planning exercise for the Port area.
• Development of gatehouse policies and procedures	• Preparation of a scheme designating key routes as clearways	• Relocation of unnecessary site-uses to offsite locations
• Establishment of a Working Group with Highway Authority to address offsite issue	• Formal scheduling of arrival and departure of cargo trucks	• Increase use of rail for the movement of goods within the port area.
• Provision of instruction cards to vehicles entering the gates of the port	• Introduction of Health and Safety pack and the conduct of safety briefings for each employee	

safety issues. Air pollution, in particular, is exacerbated by emissions from ocean-going vessels, harbour craft and cargo handling equipment. Traffic management was therefore considered a priority concern for the port as the solution to this problem would greatly enhance the management of safety, health and environmental concerns. Thus, Bangkok Port initiated a traffic management program with the support of the German International Cooperation (GIZ) under the Sustainable Port Development in the ASEAN Region project.

The port undertook a Rapid Transport Assessment to study the existing traffic situation of Bangkok Port, prepared a streamlined emission inventory and formulated a work program for the development and implementation of a Port Traffic Management Plan. Eleven solutions have been identified by applying available engineering and transport management techniques (See **Table 2**).

So far, Bangkok Port has been able to accomplish several of the identified measures. Short-term measures implemented include the appointment of a Port Traffic Management Officer, introduction of Gatehouse policies and procedures, appointment of Port Traffic Management Officer who cooperates with the Highway Authority to address offsite issues and the introduction of a safety guidebook. Medium-term measures undertaken included the introduction of a Port Park and Ride scheme on a voluntary basis and the establishment of key routes as clearways. Long-term measures have been likewise initiated including the study for Bangkok Port's Land Use Master Plan and the program for the increased use of rail for the movement of goods within the port area. All in all, the aforementioned measures have yielded significant benefits and improved the traffic management capability of Bangkok Port.

The e-Gate system will further enhance the quality of service in Bangkok Port.

e-Gate System

One of the safety programs implemented was the Bangkok Port Access Control Project – e-Gate System, which was introduced in 2011. The implementation of the e-Gate System was done in 3 phases. Phase 1 involved the use of a Radio Frequency Identification Card (RFID) for authorized persons and vehicles that regularly enter the gates. This activity started on 1 October 2011. Phase 2 of the project enabled the use of e-Payment for the Gate Entrance Fee, which started on 1 March 2012. The last phase, which is targeted for implementation by the end of 2012, will require the linkages of three computer systems namely, e-Gate System, Container Terminal Management System (CTMS), and Vessel Cargo Management System (VCMS).

The project is expected to yield a number of benefits. First of all, it will support Bangkok Port's implementation of the International Ship and Port Facility Security Code (ISPS Code), which is a comprehensive set of measures to enhance the security of ships and port facilities. It will also reduce the traffic congestion and the activity level at the gate entrance as it would control the number of vehicles and the time that they would be coming in and out of the port area. With the full implementation of the e-Gate project, it is expected that the ability of Bangkok Port to deliver quality services will be greatly enhanced.

Corporate Social Responsibility (CSR) Programs

Bangkok Port has actively participated in several CSR programs that the PAT has spearheaded. These include energy conservation, greening of the port area,

"Cycling to Protect Our World," a campaign to reduce the use of cars.

Increasing the green area inside the port.

Increasing green area outside the port (mouth of Chao Phraya River) .

"Love Our World, help tackle Climate Change" exhibition.

pollution reduction, health programs for children and other environmental programs.

Results

SHE Department institutionalized within the Port Organization

The most valuable benefit that is being considered by Bangkok Port in the development and implementation of PSHEMS is the institutionalization of an SHE Department. Whereas in the past, the big responsibility of looking into SHE concerns falls on one person and was deemed to be unsustainable, there is now a dedicated department that concentrates on purely SHE matters. This signifies a clear commitment by the port's top management that it is not taking SHE-related problems lightly. It gives a reassuring atmosphere to port personnel that they are in good hands with Bangkok Port management.

With assistance from the GIZ-supported Sustainable Port Development in the ASEAN Region project, the SHE Department is now in the process of setting up the work procedures and work instructions including daily work records and reports of accidents, accident investigation records and reports on environmental aspects.

Another indication of the benefits of PSHEMS to Bangkok Port is the notable appreciation of top and middle management on SHE concerns. This is especially evident during management meetings when managers are now demonstrating keen understanding and eagerness on how to address SHE-related problems and issues. Such a showing of concern was not as evident before the PSHEMS project was introduced.

PEMSEA audit.

DG-related incidents

With the development and implementation of PSHEMS, remarkable improvements were experienced in the handling of dangerous cargo. With the identification of potential environmental hazards, several measures were undertaken to prevent accidents in the DG area. This includes the strict regulation of access to the DG warehouse area for cargo trucks, which are now required to park in a designated area and can only enter the DG area when the dispatch process has already been completed. In addition, a safety sign was posted at the entrance showing the number of accidents that have occurred in the DG warehouse. In terms of capacity building, the DG training course has been revised based on the prescribed DG training course developed by GIZ.

In particular, a dramatic reduction in the number of incidents/accidents related to DG handling has occurred (See **Table 3**).

Table 3. Records of Accidents related to Dangerous Cargo handling.

Before PSHEMS Implementation	After PSHEMS Implementation
Explosion of warehouse in 1989	Small leak, no fire 1-2 items per year
Fire one container in 1993	
Fire in warehouse in 1990	
Explosion of warehouse in 1992	
Leakage and small fire 2-3 items per year	
Small leak, no fire 10 items per month	

Improvements in the Overall Physical Environment

With the implementation of the PSHEMS, Bangkok Port has likewise exhibited notable improvements in its physical environment, as shown by the following pictures:

Oil spill during maintenance operation

BEFORE

AFTER

Access area in front of the West Main Gate

BEFORE

AFTER

Cargo handling equipment maintenance work

BEFORE

AFTER

AFTER

AFTER

Remaining Challenges

Despite the initial success of the PSHEMS project, Bangkok Port is still facing a number of challenges that it needs to tackle in order to further improve its port operations.

- Further improvement on the awareness and appreciation levels of port personnel on the importance of PSHEMS. Bangkok Port aims to make port personnel (operational level) have the same attitude as the management level with regard to safety, health and environment.
- Improving records management.

Future Plans

To address the issue of raising the awareness and appreciation levels of port personnel with regard to SHE issues, Bangkok Port plans to integrate the topic of PSHEMS in various training courses designed for different training levels. The three-hour PSHEMS topic will be incorporated in the port basic course, operations course for level 2-6, level 6-10, terminal operation level 8-11 and in the orientation course for new staff.

Moreover, with the support of the ASEAN-GIZ Sustainable Ports Development in the ASEAN Region project, Bangkok Port will embark on the following program of actions:

- Improvement in record keeping with regard to traffic-related accidents;
- Environmental quality monitoring starting 2012, including the installation of an air quality monitoring equipment;
- Emissions inventory;
- Action Plan for Energy Conservation of Cargo Handling Equipment (December 2013–April 2017);

- Preliminary study on the reduction of greenhouse gases (GHG) by 20 percent within 10 years (2011-2020);
- Improvement in terminal operations;
- Maximum use of cargo handling equipment; and
- Reduction of traffic flow in the area.

Lessons Learned

Most of the lessons learned in Bangkok Port's experience in the development and implementation of PSHEMS are management imperatives that can also be applied in other ports. Key lessons learned include:

- Securing top management support is key to the sustainability of the PSHEMS as top management provides not just the resources needed for PSHEMS but also the overall direction and strategy that would guide the whole organization.
- To ensure that the development and implementation of PSHEMS is well planned, monitored and supported, a working group and working teams composed of representatives from all concerned units must be established. This has ensured commitment and support from the grassroots level.
- The competency of personnel tasked to develop and implement the PSHEMS must be fully addressed through proper training.
- Continual improvement of the port management system through the internal audit and management review processes are essential components for a management system to remain effective.
- To remain relevant and competitive, ports implementing PSHEMS must continually adopt its policies and procedures to applicable national and international regulations and revise existing rules and regulations accordingly.
- The crafting of a good PSHEMS Policy will give clear directions toward the attainment of targets and objectives.
- It is important to build up a culture of safety among port workers. Likewise, increasing the awareness of people concerned on the environmental impact of port operations and the problems that may arise from it lead to a better appreciation of the PSHEMS and how it can address these problems.
- Cooperation and coordination among different units concerned has proved to be an effective way in solving problems.
- Providing intensive trainings to key personnel capable enough to be trainers is an effective way to support other ports in setting up the system.
- Exchange of knowledge and experience to develop PSHEMS with other ports is a mutually beneficial way to improve port SHE governance.
- Intensive and numerous trainings of port personnel have helped raise the awareness on safety, health and environment and enhanced their competency to develop and implement a PSHEMS.
- Given limited resources, limiting the scope of work to a small manageable area but having the greatest risk has proved to be a good strategy.
- Technical assistance from a knowledgeable organization such as PEMSEA, provides a good headstart for the development and implementation of projects as large as PSHEMS.

Conclusion

Bangkok Port took early action to implement PSHEMS and is confident that with this integrated management system and with the support and cooperation of all agencies concerned, Bangkok Port can demonstrate high quality for the execution of its safety, health and environmental responsibility.

However, there are still some remaining challenges and opportunities for improvement that need to be addressed. True to its spirit of continual improvement, Bangkok Port's PSHEMS remains a continuing endeavour. Inspired by its initial gains, PSHEMS will have an ever increasing relevance in the face of new challenges and opportunities.

Bangkok Port is ready, as it has always been.

The preparation of this case study was supported by the Yeosu Project and Expo 2012 Yeosu Korea, and the Korea International Cooperation Agency (KOICA).

References:

Bangkok Port Rapid Transport Assessment Work Programme for the Development and Implementation of a Port Traffic management Plan, January 2011, ASEAN-German Technical Cooperation Sustainable Port Development in the ASEAN Region.

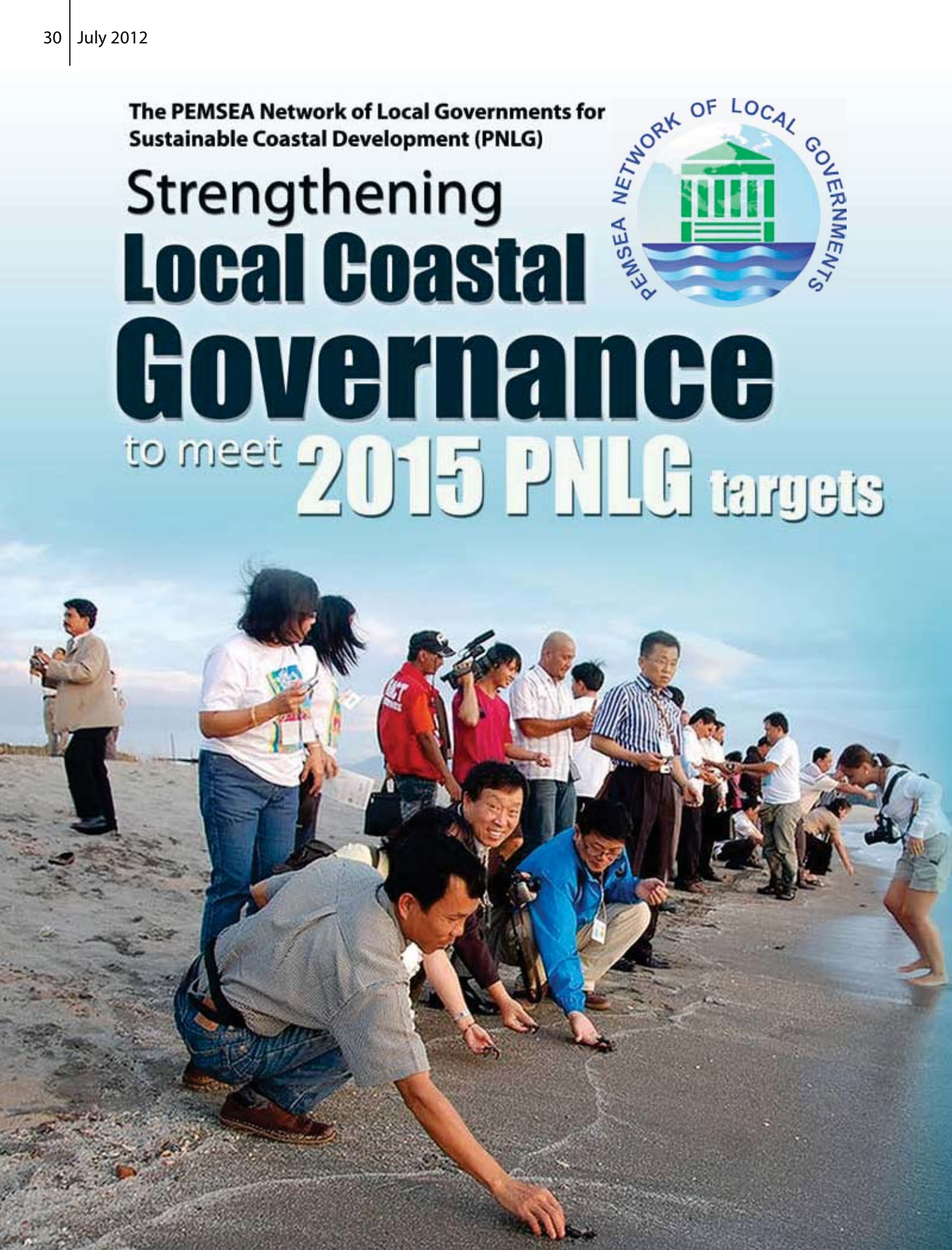
Bangkok Port Rapid Transport Assessment Streamlined Emission inventory, January 2011, ASEAN-German Technical Cooperation Sustainable Port Development in the ASEAN Region.

High Performing PAT Annual Report 2010, Port Authority of Thailand.

Review of Environmental and Safety Management Bangkok Port, Final Report 04 March 2009, Uwe Breitling, Port Environmental and Safety Consultant GTZ - German Technical Cooperation.

The PEMSEA Network of Local Governments for Sustainable Coastal Development (PNLG)

Strengthening Local Coastal Governance to meet 2015 PNLG targets



Over 100 delegates from various local governments gathered at the 11th PNLG General Assembly, held at the Changwon Hotel, Changwon City, RO Korea on 08 July 2012.

The PNLG Forum 2012 marked a significant transition for the PNLG with the changing of its leadership. After two consecutive terms, Vice Mayor Pan Shi Jian and Governor Enrique Garcia, Jr., President and Vice President of the PNLG, turned over their responsibilities to Governor Felipe Hilan Nava of Guimaras Philippines, and Vice Governor Prak Sihara of Sihanoukville, Cambodia, as new President and Vice President of the PNLG respectively. Under the new leadership, the PNLG hopes to further strengthen the partnership among the local government members and to move forward towards reaching the key targets and goals of the PNLG.

Two new members, Haiyang City, PR China and Jembrana Regency, Indonesia also joined the growing PNLG family, now with 31 regular members and two associate members. The two new members signed on and expressed their full support and commitment to the PNLG Charter as well as to the implementation of the PNLG activities.

In line with the implementation of the PNLG Strategic Action Plan and the strong resolve to meet the commitments made by the PNLG members in the Dongying Declaration on Building a "Blue Economy" through ICM — signed in the PNLG Forum 2010 — the Assembly adopted the Reporting Mechanism to Monitor and Document Progress, Achievements and Challenges in ICM Implementation and the Dongying Declaration.

The reporting mechanism is essential to help each local government member track/measure its progress as well as identify gaps and constraints in the implementation of ICM programs.

The proposed criteria to measure progress were adopted from the PEMSEA Guidebook on the State of the Coasts (SOC) reporting and the ICM Code, and will be undertaken by the local office responsible for ICM coordination.

In support of the application of the reporting mechanism, eight ICM sites (Sihanoukville, Cambodia; Dongying, China; Bali, Indonesia; Batangas, Philippines; Selangor, Malaysia; Chonburi, Thailand; Changwon, RO Korea; and Thua Thien Hue, Vietnam) shared some of their key achievements and challenges, presented the initial results of their respective monitoring reports, and provided key recommendations to further improve the monitoring and reporting format. Following the one-day General Assembly, the members of the PNLG participated at the East Asian Seas Congress International Conference.

In particular, the "Workshop on Monitoring, Reporting and Forecasting: Applications, Benefits and On-the-Ground Applications" was the focus of attention of PNLG members during the International Conference. The workshop highlighted the value of regular monitoring, evaluation and reporting in promoting adaptive management at the national and local levels. At the local level, the efforts and value of the State of the Coasts Reporting, as adopted by the PNLG members, was shared during the International Conference.

Venues for knowledge sharing among Local Governments implementing ICM

- **1st RNLG Forum, Seoul (RO Korea)**, 15-16 March 2001
- **2nd RNLG Forum, Xiamen (PR China)**, 20-23 September 2002
- **3rd RNLG Forum, Putrajaya (Malaysia)**, December 2003
- **4th RNLG Forum, Bali (Indonesia)** 20-25 April 2006
- **Inaugural Meeting of the PNLG, Haikou (PR China)**, 13 December 2006
- **2007 PNLG Forum, Danang (Vietnam)**, 5-7 September 2007
- **2008 PNLG Forum, Sihanoukville (Cambodia)**, 19-21 November 2008
- **2009 PNLG Forum, Bataan (Philippines)**, 23-25 November 2009
- **2010 PNLG Forum, Chonburi (Thailand)**, 21-24 November 2010
- **2011 PNLG Forum: Dongying (PR China)**, 25-27 July 2011
- **2012 PNLG Forum, Changwon (RO Korea)**, 8-9 July 2012

Key PNLG Achievements Over the Years:

- **2006**: Adoption of the PNLG Charter during the East Asian Seas Congress 2006 Haikou City, PR China
- **2010**: Adoption of the PNLG Five-Year Strategic Action plan (SAP) during the 9th PNLG Forum, Chonburi, Thailand
- **2011**: Adoption of the Dongying Declaration on Building a Blue Economy through Integrated Coastal Management during the 10th PNLG Forum, Dongying, PR China
- **2012**: Adoption of the Reporting Mechanism to Monitor and Document Progress, Achievements and Challenges in ICM Implementation and the Dongying Declaration.

The PNLG participants also had the opportunity to visit some of the on-the-ground initiatives in Changwon City related to coastal and marine protection. The participants were brought to the Inland Aquaculture Research Center, the Inland Water Environmental Eco-Park, Samgwi Coast, Machang Grand Bridge and the Maritime Filming Studio.

The 11th PNLG General Assembly was hosted and co-organized by the City Government of Changwon, RO Korea, in conjunction with the East Asian Seas Congress 2012 held on 9-13 July 2012 in Changwon City, RO Korea.

The PNLG, a self-sustaining network of local governments implementing ICM, is the first of its kind in the East Asian Region. The network, previously known as the Regional Network of Local Governments implementing ICM (RNLG), was established in March 2001 in Seoul, RO Korea, to serve as a forum for exchanging information and experiences in ICM practices. In 2006, the RNLG was changed into PNLG with the signing of the PNLG Charter. Since 2001, the member local governments have taken turns in hosting the annual forum and study tours.

With the 11 years' worth of growth and experience, the PNLG hopes to carry on its mission to serve as a sustainable network and advocacy group for local governments at regional and international forums to promote the application of ICM as an effective management framework to achieve sustainable coastal development.

For details on how to become a PNLG Member and more information, please contact: ***pnlg.secretariat@gmail.com*** *and visit* ***www.pnlg.org***

Dongying Declaration on Building a "Blue Economy" through Integrated Coastal Management

2011 PEMSEA Network of Local Governments for Sustainable Coastal Development Forum

Dongying City, People's Republic of China
26 July

1. We, the representatives of local governments and stakeholders of the countries of the Seas of East Asia region, have gathered this day in Dongying on the occasion of the 10th PNLG Forum, mindful of our commitments and responsibilities in promoting sustainable coastal development through integrated coastal management (ICM).
2. We reaffirm our strong commitment as a Non-Country Partner of PEMSEA in implementing the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA), which recognizes ICM as an effective management framework and a systematic approach to achieve sustainable development of the coastal and marine areas.
3. We appreciate the recognition of the crucial role of the PNLG members in achieving the target set by PEMSEA partners to cover at least 20 percent of the East Asian Seas region's coastline with ICM programs by 2015.
4. We therefore remain steadfast in our commitment to share the knowledge and experience as advocates of ICM particularly in developing, demonstrating, maintaining and continually improving the application of ICM across the region to contribute towards achieving the 20 percent target.
5. We celebrate the continuing expansion of the PNLG as more local governments and stakeholders acknowledge the value of the Network as an effective platform for information exchange and in promoting our advocacy on ICM.
6. Inspired by the increasing interest on the new concept of Blue Economy, we reaffirm our commitment to be responsive to the requirements of building a Blue Economy for the region by taking an active role in ICM implementation and scaling up.
7. We agree on and endeavor to take the following actions to achieve the key targets in the PNLG Strategic Action Plan for 2011-2015, as agreed in the 2010 PNLG Forum in Chonburi, in support of SDS-SEA implementation and in building a Blue Economy:
    a. **Mainstream ICM strategies, objectives and targets** into the local government development plans for sustainable marine and coastal development and for building a Blue Economy.
    b. **Implement the PEMSEA ICM Code and Recognition System** across 50 percent of the PNLG local government membership by 2015 as a certification of local government achievement and success in sustainable coastal development through ICM implementation.

PNLG Member Local Governments:

- Sihanoukville, Cambodia
- Dongying, PR China
- Fangchenggang, PR China
- Haikou, PR China
- Haiyang, PR China
- Laoting, PR China
- Lianyungang, PR China
- Quanzhou, PR China
- Xiamen, PR China
- Badung, Indonesia
- Bali, Indonesia
- Buleleng, Indonesia
- Denpasar, Indonesia
- Gianyar, Indonesia
- Jakarta, Indonesia
- Jembrana, Indonesia
- Karangasem, Indonesia
- Klungkung, Indonesia
- Sukabumi, Indonesia
- Tabanan, Indonesia
- Port Klang, Malaysia
- Bataan, Philippines
- Batangas, Philippines
- Cavite, Philippines
- Guimaras, Philippines
- Changwon, RO Korea
- Shihwa, RO Korea
- Chonburi, Thailand
- Danang, Vietnam
- Quangnam, Vietnam

PNLG Associate Members:

- Coastal and Ocean Management Institute, Xiamen University, PR China
- First Institute of Oceanography, State Oceanic Administration, PR China

Observer Local Governments:

- Nampho, DPR Korea
- Panjin, PR China
- Qingdao, PR China
- Wenchang, PR China
- Yangjiang, PR China

c. **Apply the State of the Coasts reporting system** across 100 percent of PNLG local government membership by 2015 to identify and validate social, economic and environmental status and changes in coastal and marine areas, and measure progress and impacts of ICM implementation among local governments of the region.

d. **Co-organize an annual regional forum for Local Chief Executives on ICM scaling up**, in collaboration with the PEMSEA Resource Facility and the Xiamen World Ocean Week, to promote and encourage Local Chief Executives from around the region to develop, implement and extend ICM as a tool for sustainable development around the region.

e. **Co-organize site-specific capacity development programs**, in collaboration with responsible national agencies, local government networks and the PEMSEA Resource Facility, as appropriate, to foster improved awareness, understanding and management and technical skills in ICM implementation.

f. Engage local governments within each PNLG member to develop and implement ICM and to join the PNLG, and **achieve a 100 percent increase in PNLG membership** by 2015.

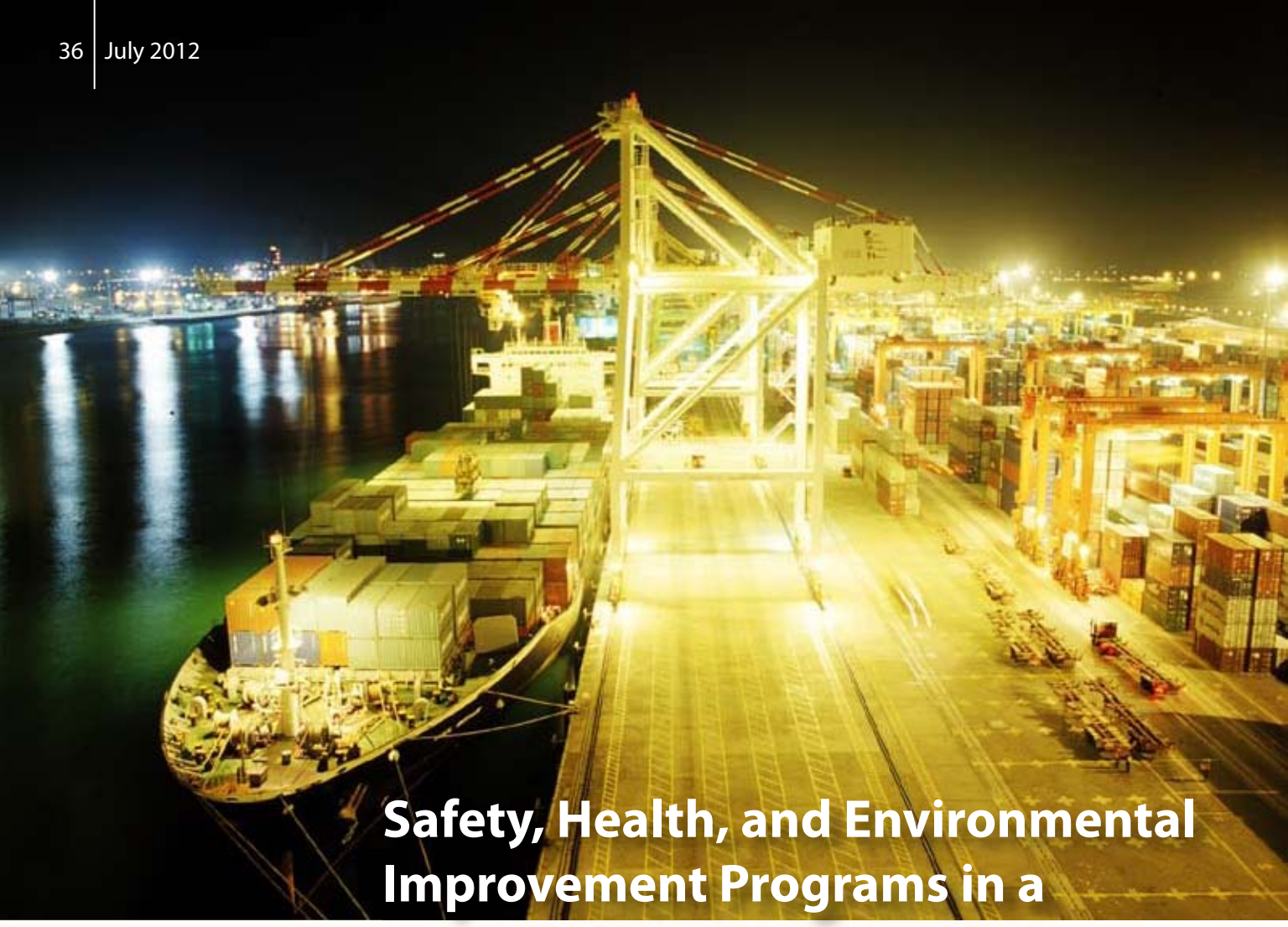
8. We will report on the progress towards meeting these targets on an annual basis during the PNLG Forum.

9. We call on PEMSEA, as the regional mechanism for the implementation of the SDS-SEA, to provide technical advice and assistance and to promote cooperation in education and training activities related to ICM and sustainable coastal and marine development.

10. We encourage international organizations, donors, scientific and technical organizations, the academe and the business sector to partner with local governments in their quest to develop and implement ICM programs.

11. We thank the Municipal Government of Dongying of the People's Republic of China for graciously hosting the 2011 PNLG forum as well as its efforts in ensuring the success of the forum.

Adopted in Dongying City, People's Republic of China this Twenty Sixth Day of July in the Year Two Thousand and Eleven.



Safety, Health, and Environmental Improvement Programs in a Rapidly Growing Port: Laem Chabang

By Mr. Buncha Apai, Administrator 13, Office of the Director General, Laem Chabang Port; and Mr. Thongchai Thammapredee, Director, Port Operations Division, Laem Chabang Port

Considered to be Thailand's most important deep sea port with a dominant share of 70 percent of the country's sea transport volume, Laem Chabang Port (LCP) brims with potential to be a truly world-class port. Under the supervision of the Port Authority of Thailand (PAT), the port's development has been fast-tracked to serve the fast-growing industries in Chonburi Province as part of the Eastern Seaboard Development Project. Since its inaugural operations in January 1991, the port has been providing services to meet its government mandate of sustaining economic growth by facilitating maritime transport and international trade.

Geographically advantaged to be situated in the crossroads of one of the fastest growing economic clusters in the world, Thailand's Ministry of Transport has adopted a policy to promote LCP as the main trading gateway of Indochina. As a main port of Thailand, it can support large-scale transportation of commodities in the region once some international mega-projects are completed in the near future, such as interconnecting routes to China and India, and trading routes in the Greater Mekong Subregion and the North-South Economic Corridor. In addition to these promising developments, the establishment of an ASEAN Economic Community also augurs well for the LCP.

LCP's operations are supported by adequate resources, modern infrastructure and spacious facilities. It has a backup area of around 1,014 ha being used as container yard, empty container depot, warehouses, pre-delivering yard for exporting new cars, cargo distribution area, etc. The port

has likewise reclaimed land of approximately 386 ha that is now serving as terminal backup area for 11 container terminals, two multipurpose terminals, one RO/RO (roll on/roll off) terminal, one passenger and RO/RO terminal, one dry bulk terminal, and one general cargo and RO/RO terminal.

The port has been providing services to various types of commodities with its existing capacity as shown in **Table 1**.

Table 1. Services provided to various types of commodities and capacities.

Terminal type	Wharf length	Capacity/year
Container	2,800 m	7.6 million TEU
Ro/Ro	1,315 m	2.0 million units
Dry bulk	450 m	1.1 million ton
General cargo	1,250 m	3.0 million ton
Passenger	365 m	70,000 DWT passenger ship

The port has posted an impressive 11.64 percent growth rate in terms of containerized cargo handling, clearly showing its dramatic rise as one of the world's busiest ports (**Table 2**).

Table 2. Containerized cargo (million TEU).

	2008	2009	2010	2011
Unloaded	2.573	2.304	2.422	2.761
Loaded	2.646	2.308	2.623	2.875
Transshipment	0.021	0.009	0.023	0.047
Total	5.240	4.621	5.068	5.658
Percent Growth	12.91	-11.80	9.66	11.64

One of the most important roles of LCP is to serve as a hub of Thailand manufactured cars for exports. The Thai government relies on LCP's role to realize its vision of becoming a "Detroit of Asia" and become the largest carmaker and exporting base in the region.

With LCP's stable performance, the anticipated volume for each type of cargo throughput in LCP in the next four years is shown in **Table 3**.

Table 3. LCP cargo traffic forecast

	2012	2013	2014	2015
Container (million TEU)	5.992	6.483	6.991	7.519
Exported cars (million unit)	1.005	1.070	1.140	1.214
General cargo (million ton)	2.901	2.956	3.002	3.040
Bulk cargo (million)	0.551	0.561	0.570	0.577

Challenges in Safety, Health, and Environment

Laem Chabang Port has encountered a number of challenges with regard to safety, health and environmental (SHE) concerns in the port. First, because LCP has been developed in a coastal area, it has experienced multi-resource conflicts among other coastal users. Furthermore, since the construction method of the port involved dredging, land reclamation and setting up of a long breakwater, shore erosion and sedimentation have occurred. In addition, LCP has been experiencing various problems that have challenged the port to come up with short-term and long-term solutions, including:

Environmental problems from massive traffic volume of container trucks

With an average volume of 6 million TEUs of container cargo per year, LCP inevitably faces the problem of massive traffic volume of container trucks, not just within the port area but also in all the roads connected to the port. For instance, traffic volume amounted to 4.549 million and 4.841 million trips in 2010 and 2011 respectively. The container trucks have brought air pollution, increasing accidents and economic loss (due to unnecessary fuel consumption during traffic congestion).

Waste management in the port

One of the environmental concerns that is being prioritized in LCP is the relatively poor waste management practices in the port and the volume of solid and hazardous wastes generated by the port's operations, as shown in **Table 4**.

Table 4. Volume of solid and hazardous wastes generated by LCP operations.

Solid waste	Total *(kg/year)*	Average *(kg/day)*
2007	552,000	1,430
2008	558,540	1,530
2009	569,000	1,559
2010	550,000	1,507

Hazardous waste	Total *(kg/year)*	Average *(kg/day)*
2007	53,840	148
2008	62,787	172
2009	n/a	123
2010	81,520	223

The Engineering Division of LCP is responsible for collecting solid waste and transferring it to a landfill in Laem Chabang Municipality. Some hazardous wastes (contaminated fabric, contaminated container, fluorescent and material scrap) are also collected by the Engineering Division and taken to a central waste storage. Then a licensed private waste operator takes them to the landfill in Laem Chabang Municipality for disposal.

In terms of oily waste from ships, LCP's waste management program needs further improvements. There is no adequate central management, registration and notification for the collection of waste from the ships. The Marine Service Division is responsible for the collection of oily waste from ships while the Port Operation Division is responsible for oily waste from equipment and workshops in LCP.

However, for regular operations, oily wastes are collected by licensed private waste collection operators and taken to treatment sites outside the port. In addition, sewage from ships is not being collected due to the relatively short time the ship stays in the port and sufficient holding tank capacity. The lack of clear procedures and regulations and the lack of transparency regarding fees and costs also add to the problem of collecting wastes from ships.

Figure 1 gives an overall view of the flow of ship waste in LCP.

With the aforementioned problems in ship waste collection and inadequate monitoring of waste handling procedures, LCP's waste management practices still needs a lot of improvement to better control health, safety and environmental aspects in the port.

Gas emission and energy consumption

Due to the increase in commercial activities of the port (posting an average annual growth rate of 5.6 percent in the volume of containerized cargo handled from 2008 to 2011) and the move towards more electrification of cargo handling equipment (to minimize air pollution from diesel fuels), energy use, particularly electric consumption, has been on an increasing trend. Electric power consumption in LCP from 2007 to 2010 is shown in the **Table 5**.

While it cannot be denied that LCP produces high volume of greenhouse gases (GHG) due to high electric consumption and the high level of fuel consumption by the millions of trucks and thousands of cargo vessels

Figure 1. Diagram of Laem Chabang Port's ship waste flow (2011).

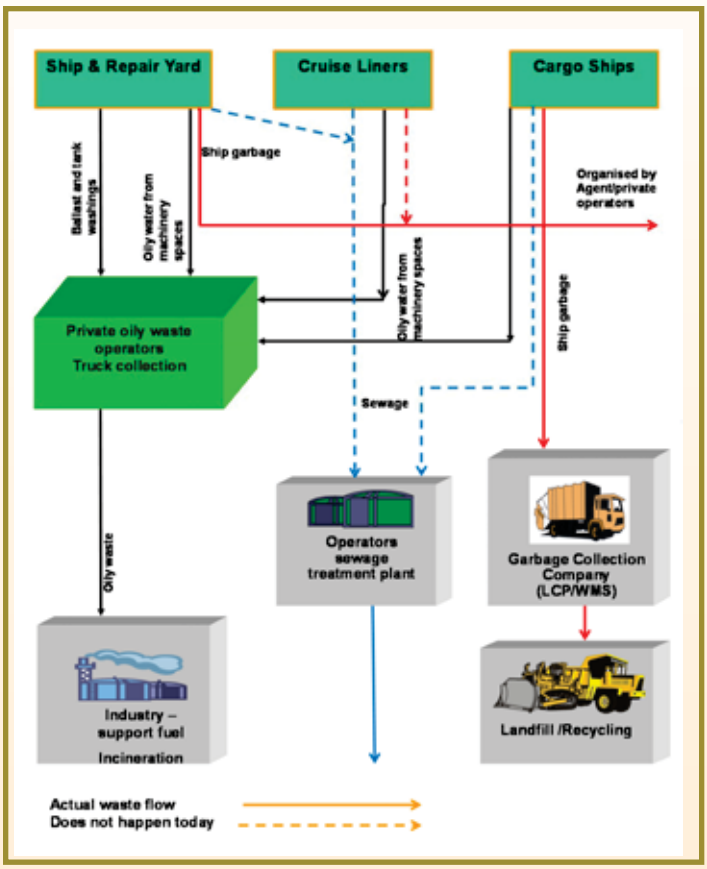


Table 5. LCP Electric power consumption from 2007–2010 .

	2007	2008	2009	2010
Electric power (million unit)	48.647	57.951	59.687	65.183
Growth (%)	-	19.13	3.00	9.21
Electric expense (million Baht)	135.32	156.76	186.27	195.39
Average (Baht/unit)	2.78	2.71	3.12	3.00

going in and out of the port, the port has been seeking measures and methods to decrease gas emission and adopt green energy in its operations to be more socially responsible and to contribute to mitigation of global warming.

Dangerous cargo management

LCP is strategically situated as a discharge point for imported materials that are transported to hundreds of factories, most of which are located in the eastern part of Thailand. At the same time, many types of dangerous cargo are also being loaded and transported to other countries using the port.

The volume of dangerous cargo (by IMO Class) LCP has handled from 2008 to 2011 is shown in **Table 6 and 7.**

While operating procedures for handling dangerous cargo within the port have been developed and implemented in accordance with IMO standards, LCP is still considered at high risk due to the sheer volume of inbound and outbound dangerous goods cargo it is handling every year (more than one million tons). In November 2009, for instance, a fire incident on a container filled with 9,142 kg of bleach powder was reported when it was stacked in a container terminal. The incident caused damages to the port's immediate environment and portrayed a negative image of the port.

With the high volume of dangerous cargo that LCP cannot just avoid or refuse to handle, it is imperative for the port to find more appropriate ways in managing dangerous cargo. This can also bring about more success in safety, health and environmental management in the port.

Port Security

LCP has been the focus of political protesters who wanted to interfere with port operations. Similar to other public enterprises, the port is sometimes vulnerable to these kinds of demonstrations. Furthermore, seaports are now known to be one of the places that are vulnerable to the risk of terrorism, involving, for example, destruction of property, port disruption and environmental damage to the country. This is one of the most important challenges to safety, health and environment, as well as security, that need to be addressed by LCP.

Experience in Adopting PSHEMS

Experience in the development, implementation and improvement of PSHEMS

The Port Authority of Thailand (PAT) agreed to accept technical assistance from the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) for the establishment and implementation of a Port Safety, Health, and Environmental Management System (PSHEMS) in LCP with the signing of a Memorandum of Agreement between the PAT and PEMSEA on October 7, 2008.

LCP was mainly responsible for facilitating the implementation of PSHEMS. A project team was established to coordinate and manage the activities programmed for PSHEMS development. PEMSEA, on the other hand, provided technical assistance through the facilitation of training workshops, review of documentation for planning, design and implementation of the PSHEM Code.

A series of trainings on PSHEMS were conducted by the PEMSEA Resource Facility (PRF) and participated in by relevant stakeholders such as the port officers, Customs, Marine Department, private terminal operators and DG warehouse operator at LCP. These trainings include:

- **Phase 1:**
  Understanding PSHEMS and conduct of hazard identification (October-December 2008)
- **Phase 2:**
  Documentation of the PSHEMS (January-February 2009)
- **Phase 3:**
  Implementing and Monitoring (March-August 2009)

Table 6. Inbound Dangerous Cargoes (million tons).

	2008	2009	2010	2011
Class 1	0.004	0.009	0.015	0.014
Class 2	0.041	0.031	0.040	0.047
Class 3	0.151	0.119	0.149	0.170
Class 4	0.062	0.025	0.033	0.046
Class 5	0.051	0.042	0.068	0.072
Class 6	0.052	0.037	0.050	0.064
Class 7	-	-	-	-
Class 8	0.111	0.088	0.115	0.140
Class 9	0.161	0.141	0.191	0.208
Total	0.637	0.497	0.665	0.765

Table 7. Outbound Dangerous Cargoes (million tons).

	2008	2009	2010	2011
Class 1	0.002	0.001	0.002	0.002
Class 2	0.045	0.036	0.036	0.050
Class 3	0.127	0.113	0.123	0.121
Class 4	0.016	0.014	0.033	0.033
Class 5	0.045	0.053	0.062	0.072
Class 6	0.015	0.011	0.009	0.016
Class 7	-	-	-	-
Class 8	0.092	0.075	0.090	0.109
Class 9	0.137	0.092	0.155	0.164
Total	0.481	0.398	0.512	0.571

- **Phase 4:**
  PSHEMS internal auditing
  (May-July 2009)
- **Phase 5:**
  Training and Conducting on continual improvement of the PSHEMS
  (July-November 2009)

With the PSHEMS documentation in place, the stage 1 audit was conducted by the PRF from August 30 to September 2, 2009. The PRF's stage 2 audit was conducted from November 2-6, 2009. Then, the Certificate of Recognition of PSHEMS was given to LCP on November 24, 2009 during the 3rd East Asian Seas Congress in Manila, Philippines.

Initially, there were some resistance from various departments in changing their own work processes. However, upon realizing the benefits of PSHEMS, and with the enthusiasm and teamwork displayed by the working team, the reluctance of these departments have been resolved. Eventually, they have gradually gone hand in hand with the working team in the development and implementation of PSHEMS.

The activities needed to develop the PSHEMS were carried out by the project team, which is made up of department managers who had to work extra hard to devote some of their time for PSHEMS development on top of their regular duties. In addition, the capability in understanding English by all the participants was also a factor in getting the most knowledge during training and workshop activities.

Nevertheless, the successful experience of developing PSHEMS as a part of the integrated management system of LCP, was made possible through the cooperation between the port and the port-related activities operators and related agencies, recognition on the importance of PSHEMS by the ports' executive officers and through the enthusiastic efforts and patience of the working team.

SHE Programs of LCP

Environmental Programs inside LCP

Sustainable Waste Management Program

In cooperation with the ASEAN Ports Association (APA) and PEMSEA, LCP has accepted technical assistance from the German International Cooperation (GIZ) for the implementation of the Sustainable Port Development in the ASEAN Region. The project's objectives are to improve the management of onshore waste generated on board ships and cargo residues, to avoid daily illegal operational spillages and discharges and to make the port modern and competitive. The project will cover discharges of solid, oily and toxic wastes and cargo residues from ships. The basic strategy is to reduce the volume of ship-generated waste into the sea by improving waste management, enhancing the availability and use of waste reception facilities and strengthening the enforcement regimes in the ports in accordance with the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL73/78). The immediate outputs of the project were the development of port regulations on waste management and development of a Port Waste Management Manual.

The program commenced in November 2011 with an assessment of existing port waste management practices in the port. A review of national legislations concerning the port and related activities was likewise undertaken. An inventory of the type of waste accepted in Laem Chabang Port was also assessed. The results of these assessments revealed the following areas for improvement in LCP's waste management practices:

- There is no central management of waste handling within the port.
- No adequate central management, registration and notification of collection of ship waste.
- Unclear procedures and regulations regarding responsibilities on ship waste collection.
- Lack of transparency regarding fees and costs for some oily waste collection.
- Current fees for garbage collection do not reflect real cost.
- There are no economic incentives for ship's crew to deliver waste.
- Monitoring of waste handling procedures is inadequate.

In May 2012, the GIZ-supported project came up with a Port Waste Management Implementation Plan for LCP to be undertaken within a six-month duration.

Green Port Program

In 2010, Laem Chaebang Port initiated a Green Port program to address its carbon dioxide emissions. The port has decided to setup a Wind Farm Powerplant as a pilot project to increase the proportion of green energy to the port's total electricity consumption and thereby contribute to the curtailment of global warming. LCP hopes that the project will serve as a model project for other government agencies and private companies in Thailand, not only as a practical example of wind turbine farm development in Thailand but also as a good example of corporate social responsibility (CSR).

Upon the recommendation of LCP's project consultants from the Applied Research Center of Wind, Water and Solar Energy in the Faculty of Engineering of Rajamangala University of Technology Thanyaburito, 84 units of 18-m high wind turbines that have been researched and designed especially for ports will be installed in the first phase of the project. With a 10 kW/hr capacity, the combined power generation capacity of all 84 units is around 840 kW/hr. Interconnected by a grid inverter system, the wind turbine system is expected to generate electricity at an average of 2.5 million units/yr, which can also be expected to help decrease CO_2 emissions to the

atmosphere by about 1.4 million tons CO_2/yr.

With an investment budget of Baht 135 million, the project is now under the process of installing the turbines in the port site. Although its capacity may be quite small compared to bigger wind turbines in other ports in Asia and Europe (e.g.,1,250 or 1,500 kW/hr/unit,) this project can realize the LCP's intention of initiating a green port program that is suited to the natural conditions around the port. The project is expected to be completed by August 2012. With funding of around Baht 165 million, the second phase of this project will focus on research on the best alternative way of green electric power generation, such as solar and wind energy. The research will also review both good and weak points that have occurred in the first phase to come up with a better design and a more suitable model for the second phase.

Low Carbon Port Program

Carbon dioxide and other GHG emissions in LCP comes from two major sources: from cargo handling equipment operated by terminal operators; and from ships calling the port. To address these problems, LCP's Low Carbon Port Program will encourage all private terminal operators in the port to switch from diesel fuel to electric power in operating cargo handling equipment. LCP will likewise apply more electric supply for ships berthing at the quay wall.

Some private terminal operators, such as the LCB Container Terminal 1 Ltd, have actually started to modify their heavy duty handling equipment (e.g., Rubber Tyre Gantry (RTG) crane) from using only diesel fuel to electrical power. After connecting the RTGs to the terminal electricity supply, it is expected that a reduction of about 1.80 ton of CO_2/yr will be achieved for the 20 RTGs in this terminal.

In addition, since March 2009, Hutchison Laem Chabang Terminal Co., Ltd. has also started installing about 12 units of electric RTGs in container terminals C1 and C2. It is now the policy of LCP that all new RTG installations will be electric-powered to support LCP's Green Port Program. In fact, some private terminal operators are already in the process of modifying their heavy duty handling equipment in line with this policy.

As for the electric supply for ships berthing at the quay wall, a feasibility study and engineering design for LCP's Phase III development will be undertaken and would involve the study and design for a "Cold Ironing System." Construction work for the development

of LCP's Phase III is expected to start by the year 2013 or 2014. The project will embark on the development of an "innovative port", which aims to introduce "green port" improvements to the new terminal and modify the old terminals to make them more environment-friendly.

Natural Resources Conservation

Situated in a coastal area of a Laem Chabang village, the port has a natural mangrove forest covering an area of about 4.5 ha that is teeming with fauna and flora species. To preserve its diversity, LCP, together with Laem Chabang Municipality and Kasetsart University, Sriracha campus, entered into a Memorandum of Understanding in the latter part of 2008 to collectively undertake activities that would preserve and rehabilitate the mangrove forest.

This natural resources preservation program has also encouraged people to participate in many activities together such as collecting garbage, surveying types and density of mangrove plantation, replanting of the destroyed areas of the forest, monitoring sea water quality, etc. Moreover, academic activities have been conducted to enhance knowledge about environment and natural resource preservation to the village people and school and university students around the port. Furthermore, the forest is used as a recreation site for the general public.

LCP has likewise undertaken other activities related to natural resource rehabilitation, such as planting trees within and around the port.

Port Air Emission Inventories Assessment

From September to December 2010, an air emission inventory was carried out in Bangkok Port under the the GIZ/ ASEAN Sustainable Port Development in the ASEAN Region project. With the successful implementation of the project in Bangkok Port, the GIZ started to provide similar technical assistance to LCP in 2011, carrying out an air emission inventory within the port covering the following sources:

- Port direct sources including all air pollution emission sources directly under the control and operation of the port administration entity, port-owned vehicles, buildings (e.g., boilers, furnaces, etc.), port-owned and operated cargo handling equipment, as well as any other emissions sources that are owned and operated by the port administrative authority.
- Port indirect sources including port purchased electricity for port administration-owned buildings and operations (excluding "offsite" tenant power and energy purchases).
- Other port indirect sources including tenant operations, ships, trucks, cargo handling equipment, rail locomotives, harbor craft, tenant buildings, and port and tenant employees commuting in the port. In addition, onsite emissions included if possible.

Safety/Health Programs inside LCP

SHE Regulations Development Program

LCP, in cooperation with the GIZ project, has currently developed the Laem Chabang Port Ordinance (Port By-Laws) which also covers SHE regulations. A total of 11 meetings were held among port officers, terminal private operators, dangerous cargo warehouse operator, marine department and the GIZ project from December 2010 to November 2011. A draft of the Port By-Laws has now been completed covering port regulations on traffic management, port navigation, miscellaneous regulation, safety, dangerous goods, waste disposal and business statistics, and electronic data processing/data protection.

The draft port regulations will be submitted to the PAT's Director General in July 2012 and then to the PAT's Board of Commission in September 2012 for approval. The Port By-Laws should be one of the tools that can be used to more effectively control and manage SHE in the port in compliance with international regulations.

SHE Results delivery by the PSHEMS

SHE Regulations Development Program

Every year, LCP is implementing environmental quality monitoring within the port on the following parameters:

1. Ambient Air Quality (2 times/year) in 12 stations.
2. Noise Level (2 times/year) in 12 stations.
3. Wastewater from Water Treatment Plant (weekly) in 2 stations.
4. Seawater (4 times/year) in 11 stations.
5. Sediment in the Sea (2 times/year) in 11 stations.
6. Biological in the Sea (2 times/year) in 11 stations.
7. Coastal Change (1 time/year) in 9 stations.
8. Social and Economic (1 time/year) 4 stations.

Results of ambient air quality examined from 2008-2010 showed that total suspended particle, carbon monoxide, sulfur dioxide, total hydrocarbon and nitrogen dioxide in the port area and nearby communities are within the acceptable standards issued by the Department of Pollution Control, Ministry of Natural Resource and Environment. **Tables 8 and 9** show some examples of the air quality monitoring results.

With regard to seawater, biological and sediment monitoring, samples collected from 11 stations have shown that in spite of the fact that the port has been operating for more than 20 years already, environmental quality in the port is still in good condition (**Table 10**).

Moreover, noise level, socioeconomic and coastal line monitoring have also been examined regularly for the past several years. The results showed that noise level is within the limitation standard, while erosion and sedimentation are acceptable. On the other hand, the socioeconomic survey revealed that

the port activities have negatively impacted on the community around the port area mainly because of dust and massive traffic congestion. These adverse impacts are being taken into consideration by the port management to find areas for improvement and formulate appropriate action plans accordingly.

Lessons Learned

In the course of developing and implementing the PSHEMS, LCP has learned the following valuable lessons:

- It is important to have a dedicated working unit within the LCP organization that would oversee the development and implementation of PSHEMS. This requirement is essential in order to avoid the situation wherein no one wants to take responsibility and accountability on the activities required to develop and implement the PSHEMS.
- English proficiency plays a big role in the development and implementation of PSHEMS as it is a significant factor in the learning process of concerned personnel.
- Top management support is important for the sustainability of the PSHEMS.
- Trainings are very important to address the competency requirement of PSHEMS.

Table 8. Air quality monitoring results on suspended particles.

Sampling Stations	Total Suspended Particulate *(mg/m³)*					
	1/51	2/51	1/52	2/52	1/53	2/53
Checking Gate (Station 1)	0.035-0.053	0.050-0.078	0.053-0.100	0.068-0.112	0.057-0.127	0.210-0.239
Checking Gate (Station 2)	0.118-0.157	0.044-0.115	0.031-0.041	0.039-0.069	0.026-0.072	0.036-0.062
Entrance of Leam Chabang Port	0.129-0.160	0.078-0.152	0.025-0.039	0.045-0.063	0.028-0.064	0.219-0.245
Laem Chabang Port Fire Protection Training Center	0.035-0.053	0.013-0.047	0.016-0.022	0.044-0.062	0.021-0.032	0.022-0.031
Technology Sriracha School	0.057-0.073	0.014-0.089	0.011-0.043	0.056-0.076	0.271-0.392	0.029-0.086
Tanaporn Witthaya School	0.020-0.042	0.013-0.037	0.029-0.033	0.021-0.056	0.019-0.030	0.032-0.041
Terminal A4	0.033-0.052	0.028-0.067	0.015-0.035	0.015-0.039	0.013-0.018	0.038-0.042
Terminal B4	0.020-0.042	0.177-0.323	0.037-0.069	0.058-0.207	0.075-0.133	0.091-0.226
College of Community Development	0.017-0.022	0.009-0.033	0.013-0.035	0.013-0.022	0.006-0.041	0.025-0.043
Terminal C3	0.025-0.029	0.020-0.029	0.025-0.049	0.016-0.027	0.014-0.034	0.042-0.098
Terminal C0	0.019-0.036	0.033-0.054	0.014-0.020	0.013-0.050	0.006-0.042	0.033-0.052
Standard	**0.033**					

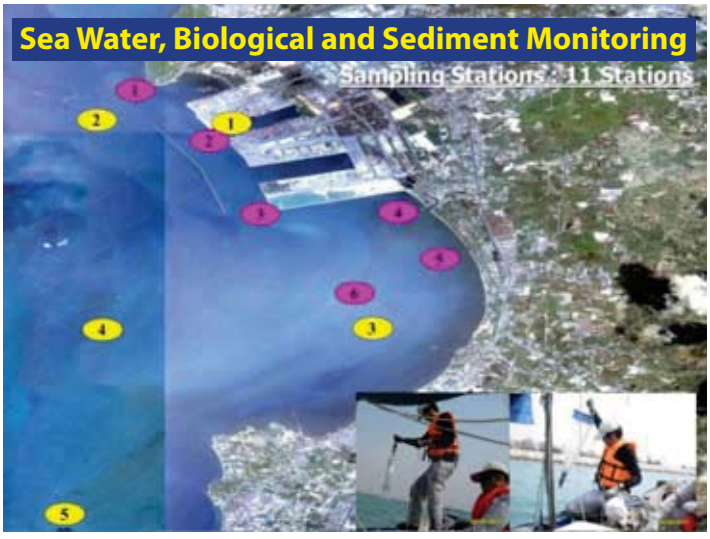


Table 9. Air quality monitoring results on carbon monoxide.

Sampling Stations	Carbon Monoxide *(ppm)*					
	1/51	2/51	1/52	2/52	1/53	2/53
Checking Gate (Station 1)	0.048-0.066	0.16-0.20	0.23-0.052	3.53-3.73	0.23-0.35	0.20-0.60
Checking Gate (Station 2)	0.18-0.21	0.47-0.69	0.26-0.73	3.04-3.23	0.12-0.41	0.19-0.49
Entrance of Leam Chabang Port	0.49-0.58	0.65-0.89	0.25-0.40	3.24-0.48	0.17-0.48	0.16-0.47
Laem Chabang Port Fire Protection Training Center	0.48-0.66	0.43-0.87	0.22-0.52	2.12-3.02	0.19-0.43	0.16-0.46
Technology Sriracha School	0.43-0.61	0.39-0.51	0.23-0.52	3.50-3.89	0.23-0.35	0.18-0.59
Tanaporn Witthaya School	0.36-0.44	0.74-0.82	0.27-0.44	2.21-3.32	0.16-0.36	0.18-0.52
Terminal A4	0.31-0.33	0.44-0.85	0.25-0.51	2.64-3.16	0.21-0.43	0.15-0.44
Terminal B4	0.36-0.44	0.52-0.80	0.28-0.35	3.17-5.77	0.18-0.46	0.17-0.57
Standard	**9**					

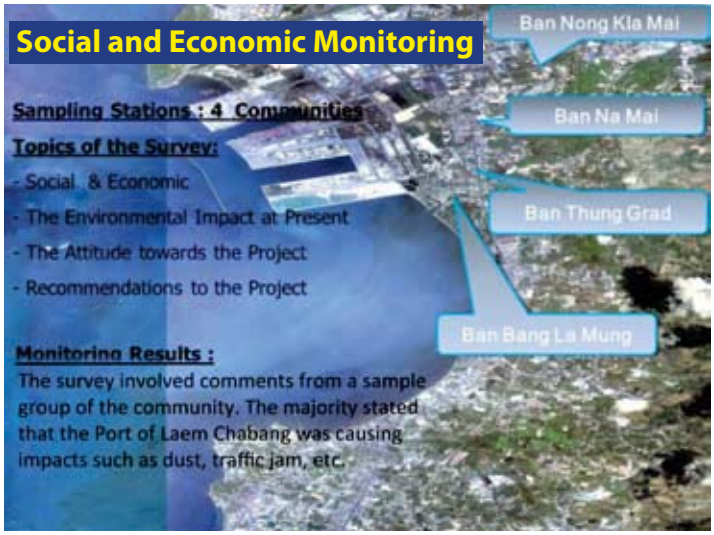
Table 10. Seawater quality analysis results from 2008-2011 (Laem Chabang Port Phase 2).

Sea Water Quality Analysis Results from 2008 - 2011							
Parameters	**Station 1**	**Station 2**	**Station 3**	**Station 4**	**Station 5**	**Station 6**	***Standard***
Temperature (ºC)	28.4 - 32.6	28.6 - 33.2	26.9 - 33.4	27.0 - 33.4	29.6 - 33.7	27.1 - 33.0	-
Transparency (m.)	1.2 - 3.0	1.5 - 2.8	1.0 - 2.2	0.4 - 2.5	1.0 - 2.5	2.0 - 3.5	**N'**
Conductivity (µmhos/cm)	39,670 - 51,600	39,130 - 52,400	39,430 - 52,200	38,950 - 51,400	39,280 - 52,100	31,450 - 51,000	-
pH	7.88 - 8.19	7.96 - 8.20	7.89 - 8.24	7.88 - 8.23	7.97 - 8.31	7.94 - 8.31	**7.0 - 8.5**
Salinity (ppt)	27.8 - 35.2	27.3 - 35.1	28.3 - 35.4	28.0 - 34.1	26.3 - 35.0	28.5 - 34.0	**N**
SS (mg/L)	1.32 - 3.67	1.49 - 4.8	1.24 - 3.86	2.03 - 5.1	4.1 - 10.42	2.0 - 5.37	-
DO (mg/L)	6.6 - 9.0	6.4 - 8.3	7.0 - 8.0	6.4 - 8.0	6.4 - 8.0	6.7 - 8.0	**≥4**
BOD_5 (mg/L)	0.9 - 2.0	1.0 - 2.0	<1.0 - 2.0	<1.0 - 2.0	1.0 - 2.0	0.5 - 2.0	-
Grease and Oil (mg/L)	None to 0.7	None to 0.8	None to 0.6	None to 0.8	None to 0.8	None to 0.7	*
TCB (MPN/100 mL)	2 - 2,400	<1.8 to 4,900	<1.8 to 15	<1.8 to 15	<1.8 to 4,900	<1.8 to 9	**≤1,000**
Pb (µg/L)	<0.5 to 4.0	<0.5 to 3.0	<0.5 to 4.0	<0.5 to 3.0	<0.5 to 7.0	<0.5 to 5.0	**≤8.5**
Hg (µg/L)	<0.05 to <0.1	<0.05 to <0.1	<0.05 to <0.1	<0.05 to <0.1	<0.05 to <0.1	<0.05 to <0.1	**≤0.1**

Standard: Standard of Sea Water Quality (Class 5), Notification of National Environment Board, No. 27, 2006 (B.E. 2549)

Remarks: * = None visible Grease and Oil on water surface
N' = Not lower 10% than lowest turbidity of natural condition
N = Variation not exceed than 10% of lowest salinity

Legend: SS = suspended solids; DO = dissolved oxygen; BOD = biochemical oxygen demand; TCB = total coliform bacteria.



- Successive internal audits and management reviews are good in identifying areas for improvement.
- Technical assistance from a knowledgeable organization such as PEMSEA, significantly accelerates the pace of development and implementation of large projects like PSHEMS.

Conclusion

Since the adoption of PSHEMS as a part of the integrated management system of LCP, positive results have been generated. The port's safety and health conditions have been improved by regularly implementing and doing internal audits in order to better conform to the PSHEM Code. Moreover, environmental quality has been within the acceptable standards of related government agencies.

However, many aspects in relation to the PSHEMS such as the port regulations, air emission inventory, sustainable waste management system, green energy project, etc., are still under development. Hopefully, when these programs are already being fully implemented, more positive results from the PSHEMS initiative can be realized.

The preparation of this case study was supported by the Yeosu Project and Expo 2012 Yeosu Korea, and the Korea International Cooperation Agency (KOICA).

Sustainable Tourism Development: Case Study in Denpasar Municipality, Bali, Indonesia

By I Ketut Sudiarta, Lecturer and Researcher, Fisheries and Marine Science Department, Warmadewa University, Bali, Indonesia.

Background

Bali, as a small island, has limited natural resources. Development is primarily based on cultural values and environmental services provided through the tourism sector. Most of the famous tourist destinations in the island are located in the coastal zone, which is not only economically important but socioculturally as well. The majority of the Balinese are Hindus and they believe that the marine and coastal area is sacred. Hence, many religious activities take place there.

However, development along the coastal area has increased environmental and social problems. Pollution and degradation as well as threats to the sacred areas have become more complex. Socioeconomic gaps and multi-use conflicts of marine resources have also worsened.

Much of the natural resources degradation may have resulted from sub-optimal, unsustainable and sectoral management. Considering existing potential resources, opportunities, challenges and problems, appropriate coastal management is important and strategic for the future. There are six reasons why the marine and coastal areas, including small islands, need to be managed carefully (Dahuri, 2002):

1. The coastal area has a very high biological productivity, which supports the values and functions of the coastal environment to provide living resources and environmental services.

2. The coastal area and small islands have beautiful and unique ecosystems for recreation and tourism. They are also strategic for transportation activities, services and distribution of goods, industrial activities, human settlement, business and other human activities.

3. The dense population and high level of development along the coastal areas put much pressure on the coastal environment thereby also increasing vulnerability to natural disasters.

4. Coastal and marine resources are commonly open access, that is, any user has rights to use the resources. This condition gives opportunities to people to exploit the resources as much as possible. Thus, achieving marine resources sustainability becomes difficult.

5. Small islands specifically, which are mostly remote and isolated, are quite fragile to global environmental changes. In the future, small islands management needs to be enhanced. Community-based management and carrying capacity must be considered.

6. Poor people, particularly fishers, are affected most by mismanagement of marine resources and limited access to capital, technology, information and market.

Integrated coastal management (ICM) as a new approach to address complex issues in the coastal area was initiated in 2000 through collaboration between the GEF/UNDP/IMO Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) and the Government of Bali Province. The project aimed to motivate paradigm shifts in concepts, approaches and methodology employed to resolve environmental problems and promote sustainable development in coastal areas. The new paradigm makes serious efforts to build local capacity within the local government and community in order to implement more holistic and integrated approaches as well as to develop a good coordination mechanism for resolving coastal environment problems, identify opportunities for and develop environmental investments, empower the community and improve scientific contribution to environmental management. Kota Denpasar (Denpasar municipality) was one of the ICM demonstration sites in Bali. This case study is focused in the Sanur area in Denpasar (**Figure 1**).

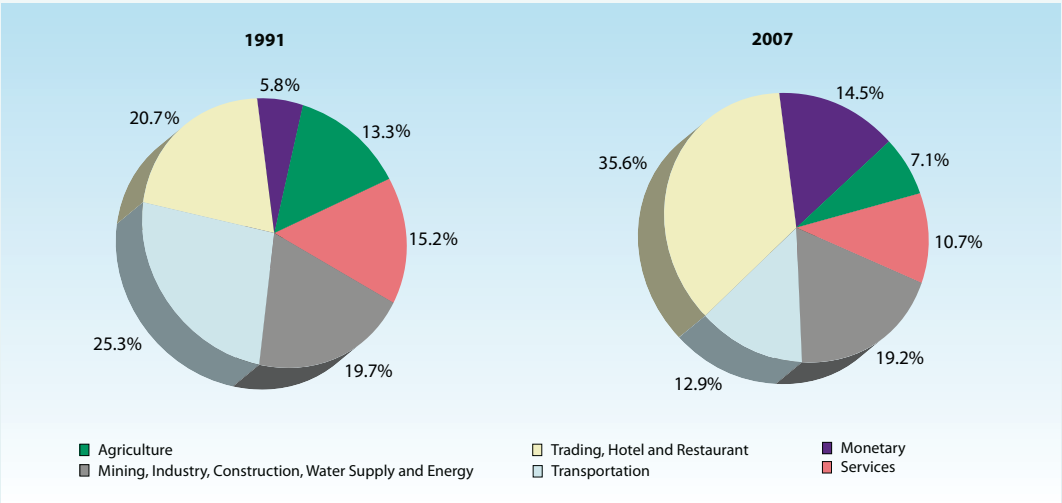
Figure 1. Study Area.

Denpasar Coastal Areas

Denpasar, the capital of Bali Province, has a land area of 127.78 km^2 and a population of 608,595 in 2007. The municipality serves as the parameter of Bali economic development and the main gate of Bali. Its economic pillar is the tourism industry and several sectors related to it have a dominant contribution to the regional gross domestic product (GDP).

The center of tourism development in Denpasar is located in the coastal area of Sanur. Tourism development in Bali also started in this area, which used to be a traditional fishing village, but is now an international village and center of tourism in Denpasar Municipality. In 1991, 18 star hotels (with a total of 2,312 rooms) were built in Sanur. By 2007, Sanur already had 23 star hotels (2,844 rooms) and 227 non-star hotels (4,849 rooms). The contribution of the tourism sector to the regional GDP increased from 20.7 percent in 1991 to 35.6 percent in 2007 (Statistics of Denpasar Municipality, 1991–2008) (**Figure 2**).

Figure 2. Structure of Denpasar's economy in 1991 and 2007.



Reference: Statistics of Denpasar Municipality, 1991–2008.

Box 1. Peaks and Ebbs of a Tourist Economy.

Tourism in Denpasar accelerated most in 1990–1996. However, in 1997–2006, Bali tourism, in general, was negatively influenced by the economic crisis (1997), political chaos (1998), Gulf war and the World Trade Center tragedy (2001), and the two bombing events in Bali (2002 and 2005).

In 1990-1997, the average growth rate of foreign visitors arriving directly in Bali was 17 percent per year with a peak number of 1,140,988 persons in 1996. Trading and tourism-related industries grew rapidly. In 1990–1996, the economic growth rate of Denpasar averaged at 9.9 percent per year although it declined to 2.7 percent per year in 1996–1997. However, since 2007, the economy has been showing recovery, at 5.6 percent (Statistics of Denpasar Municipality, 1991–2008).

Public Works Agency of Bali Province

Sanur beach


I Ketut Sudiarta

Sanur beach

Sanur has a beautiful, panoramic and white sandy beach stretching 7 km. The coast is clean and the waters are calm. Sanur is a good place to watch the sun rise. During clear weather in the morning, the view is further charmed by the Agung Mountain, the highest mountain in Bali, and the Nusa Penida islands, small islands at the southeastern cross of Bali. The sight of traditional fishing boats (called *jukung*) along the edge of the beach adds to the serenity of the area.

Coral reefs, typically barrier reefs, have developed along the beach. Physically, the reefs act as coastal barriers protecting the beach and coastal communities from storms, wave damage and erosion. White sand is also produced from the coral reef ecosystem to supply the beach sediments. The coral reefs linked to the seagrass beds are biologically diverse and produce communities. They are home to several marine species and are used by countless other marine species at some point in their life cycle. The surrounding waters are rich in fishes and invertebrates which are essential food sources for coastal communities. The coral reefs also attract tourists, boosting the local economy.

There are also historical sites and archeological artifacts along the coastal areas, making Sanur socioculturally rich. For the Hindu Bali society, the beach and the sea are considered sacred. As such, they should be protected in order to sustain religious ceremonies being held there by the local people as well as those from other places. Some temples have also been built in the area.

Unification among diversity, high values of coastal environment services, and cultural and tourism values make Sanur a famous tourist destination in Bali. In marine tourism, the activities relate to "triple s" — sun, sea and sand. The local community has capitalized on these by offering such activities and facilities as diving (scuba, snorkeling), sailing, fishing, surfing (board, kite and wind/sailing), reef watching (glass bottom, seawalker), water and marine sports (banana boat, jet skiing, parasailing, canoeing, swimming), beach recreation (sunbathing), etc.

Problems and Threats on the Coastal Environment

Three decades ago, Sanur was a traditional fishing village characterized by a stable beach, healthy coral reefs and rich fishery resources. At that time, the beach was protected landward by dense vegetation, namely, per-caprae formation (such as *Ipomoea pescaprae*, *Spinifex littoreus*, *Clerodendron inerme*, *Calotropis gingantea*, *Pandanus tectorius*) and Baringtonia formation (such as *Baringtonia* sp., *Callophyllum inophyllum, Thesfesia populnea*, *Terminalia catappa* and *Hermandia feltata*. Land and marine ecosystems harmoniously interacted with and strengthened each another.

With tourism development, environmental pressures from human activities on land and at sea came about, causing the deterioration of the coastal environment. Initially, the problems consisted of beach erosion, deterioration of ecosystems and pollution. Later, there was a new awareness of Sanur becoming highly vulnerable to natural disasters such as storms, flooding, tsunami and sea level rise. The complexity of the area's environmental problems is shown in **Figure 3**.

Rapid development in Kota Denpasar was followed by a high rate of urbanization. Population growth rate in 1990-2000 was 3.01 percent per year, which increased from 2.78 percent per year in 1900-1990. The population

density of Denpasar in 1990 was 2,628 persons/km^2 , which increased to 4,214 persons/km^2 in 2000 and 4,909 persons/km^2 in 2007 (Statistics of Denpasar Municipality, 1991 to 2008).

The high rates of population growth and development were followed by uncontrolled land conversion. About 440 ha (12.3%) of ricefields were converted to developed land from 1995 to 2000, and 430 ha (13.7%) from 2000 to 2007. The proportion of developed land to total area in 1995 was 46.5 percent; in 2000, 58.6 percent; and in 2007, 61.3 percent (Statistics of Denpasar Municipality, 1991–2008). The maximum ratio should only be 40 percent.

Pollution. Coastal water pollution in Sanur area was caused dominantly by liquid and solid wastes from land-based activities. The sources included households, hotels and restaurants and industries, among others. The dense settlements in Denpasar were not provided with adequate waste treatment. Many hotels along the beach discharged their untreated sewage to the sea. Poor waste management turned the coastal water into a reservoir of wastes. Based on an environmental risk assessment in 2002, seawater quality parameters of concern included biochemical oxygen demand (BOD), phosphate, nitrate and *Escherichia coli (E. coli)*.

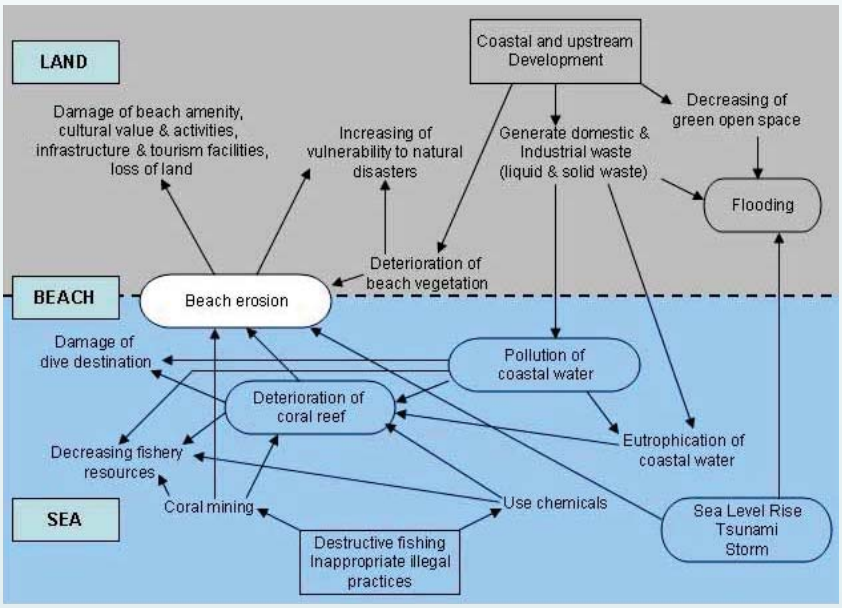
Coral reef destruction. Coral reef resources have been seriously degraded in many parts of Sanur. The causes included both human-induced and natural factors. Human-induced factors included intensive collection and extraction of corals, ornamental fish trade, destructive fishing methods, pollution, anchor damage, careless diving, and overfishing, among others. As a critical habitat, the coral reefs were also threatened by high levels of nutrients that caused eutrophication in the reef environment leading to excessive growth of green algae that widely kills corals. In 1998, there was only an average of 36.1 percent live coral cover in Sanur (Sudiarta, 2000). The coral reef degradation in Sanur had serious consequences for tourism, fishing, beach stability and biodiversity.

Beach erosion. Another environmental problem in the whole island of Bali is beach erosion, which usually can be due to natural causes but can be accelerated by human-induced factors. The threat will continue to increase with sea level rise caused by global warming. A 6 to 7 km long beach in Sanur was seriously eroded in 1997. Serious socioeconomic problems occurred with the erosion and loss of beach, such as damage to infrastructure (e.g., houses, roads, temples, recreation sites) and commercial property (e.g., land, hotels, restaurants). The human-induced factors that directly and indirectly accelerated beach erosion in Sanur included the following:

- coral mining and pollution;
- construction of coastal engineering structures (such as groins and breakwaters);
- reclamation of Serangan Island;
- alteration of vegetation along the beach; and
- invasion of beach setback line by buildings.

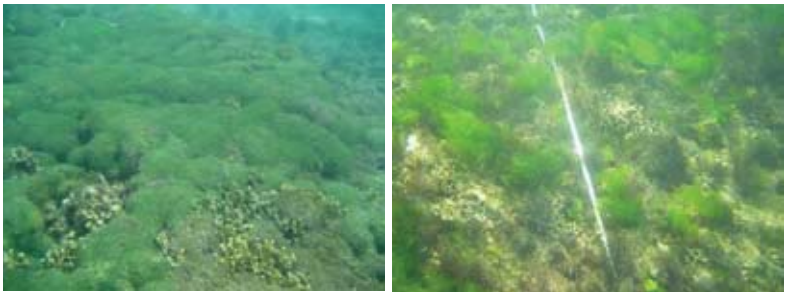
Hotels along the beach constructed some groins and breakwaters spatially in order to control erosion. However, many of these structures induced downdrift beach erosion.

Figure 3. Interrelationships among human activities and natural impacts to the coastal ecosystems.



Natural disasters. The tsunami in Aceh in 2004 and in West Java in 2005 raised the consciousness of the Sanur coastal community to the high risks they face. The risk of tsunami disaster in Sanur is high as it is located close to the zone of an earthquake generator in the Indian Ocean. Furthermore, Bali is located at a triple junction plate convergence, namely, the Eurasian Plate, Pacific Plate and India-Australia Plate, hence, it is a tectonically unstable area and is one of the very active continental edges in the world.

According to a seismic-tectonic map, Bali is located in an earthquake lane with a high seismic zone. An earthquake with a 7.3 magnitude occurring at 300-km depth had an epicenter at



I Ketut Sudiarta

Some coral reefs covered by green algae in Sanur.

the northeastern part of Denpasar. A tsunami is induced by an earthquake which has an epicenter at sea. Data from the Meteorology and Geophysics Agency in Regional III of Denpasar showed that majority of earthquakes in Bali occur in the sea (**Figure 4**).

A numerical model was applied in 2007 to assess a tsunami scenario in Denpasar (Diposaptono, 2007). The model used historical tsunami data, fault parameter using a tsunami case in East Java in 1994 and other parameters based on tsunami histories that were generated by tectonic earthquakes along Sunda Arc with an earthquake magnitude of 6 to 7 on the Richter scale and a distance from the beach of 200 km. The information was analyzed using geographic information system (GIS). The scenario results showed that:

- The tsunami reaches the beaches in Denpasar within 35-40 minutes after the earthquake.
- The high wave of tsunami at sea is 11 m.
- The high wave of tsunami on the beach is 5 m.

The vulnerability of Denpasar to a tsunami was assessed in order to prepare a strategic plan for mitigation impacts, which are particularly important in view of the characteristics of the area as follows:

- Physically: the geomorphology of the area is a low-sloping coastal plain.
- Economically: it is a center of tourism and of economic infrastructure.
- Demographically: it has high population density.
- Socially: the coastal community, in general, has low level of knowledge and awareness of and preparedness to risks from natural hazards.

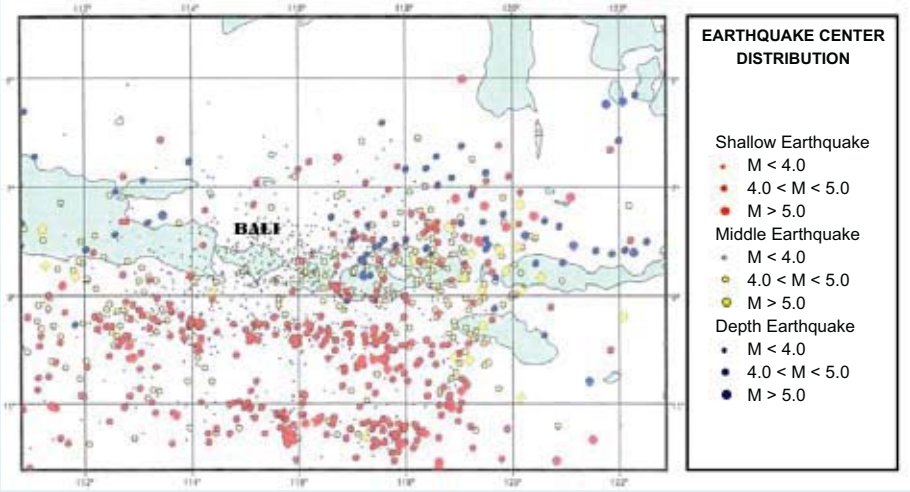
Integrated Beach Conservation Program Through the ICM Approach

The initiation of the ICM program in Bali in 2000 coincided with the genesis of reforms era in Indonesia. Political reform through Act No. 22/1999 concerning Local Government became an entry point for policy change on coastal resource management in the country. The act entails decentralization and the transfer of authority on coastal and marine resources to the local government as an autonomous body.

The ICM program in Denpasar municipality was implemented together with the beach conservation program. As Sanur is the focal point for coastal area and tourism, the beach conservation policy emphasizes that it is in the best interest of the local government to achieve sustainability of resources and long-term protection of tourism assets. On a micro scale, the beach conservation program was addressed to rehabilitate the eroded beach. On a macro scale, it aimed to develop sustainable tourism destinations in the coastal area with a healthy ecosystem, beautiful beach, enjoyable recreation, clean human habitat and an environment safe from hazards and disasters.

A regional coastal management strategy was organized to address the cumulative environmental impact. A vision to realize sustainable coastal development based on sociocultural values in Denpasar was implemented through the ICM approaches. Integrated approaches were developed involving: (a) institutional strengthening and local capacity building; (b) improving awareness, participation and responsibility among all stakeholders; (c) economic empowerment of the coastal community; (d) developing environmental investments; (e) restoration and rehabilitation of the coastal ecosystem; and (f) integrated natural disaster mitigation and management (see **Table 1**).

Figure 4. Distribution of earthquakes centered in PGR Region III in 2007.



Reference: Meteorology and Geophysics Agency of Denpasar, Region III, 2007.

Public Works of Bali Province

Eroded beaches in Sanur before rehabilitation.

Strong leadership and policy support of the ICM program. In terms of ICM achievements, Denpasar is the most progressive among the other regencies in Bali. This has been due to the strong leadership and commitment of the Regent (Mayor), who has led Denpasar since 2000. The strong leadership has been important in creating a strong interagency coordinating mechanism, which ensured broad and effective participation of government agencies and other stakeholders, including the local community.

The Regent's strong commitment was indicated by the local government's significant progress in the preparation of ICM planning documents and in strengthening ICM implementation in terms of organization, finances and facilities. Denpasar was also the first municipality to develop an integrated land-sea use plan. The scheme of the coastal use zoning was adopted and integrated in the Regional Land Use Plan. The municipality also has a special Strategic Plan for Coastal Disaster Mitigation Impact based on the Regional Action Plan for Disaster Mitigation Impact. A Disaster Management Board was also created.

Collective awareness and responsible participation of stakeholders. Balinese society in general is characterized by obedience to customary institutions and respect to prominent figures and customary leaders. With these values, the following approaches were used to increase ICM awareness through the customary village:

- Conduct of public awareness campaigns through the customary village.
- Developing community environmental awareness program based on customary village through collaboration between the local government and a nongovernmental organization (NGO), focusing on education and training on and applications of small-scale garbage management and processing. Small-scale businesses on garbage processing were developed as demonstration units in the application of the "Triple R" (reduce, recycle and reuse).
- Giving the Tri Hita Karana award for hotels that have good practices in environmental management. The corporations in the tourism sector, as main users of coastal resources, have important roles within the coastal environmental management programs. They have the responsibility to manage their environment in accordance with the Tri Hita Karana, which pertains to three relationships that humans need to sustain to achieve balance in Balinese society: with their God, with their fellow humans and with their natural environment.

Table 1. Roles and functions of ICM framework in several activities of the beach conservation program in Denpasar municipality.

Integrated Beach Conservation Program/Activities	ICM Function	Implementation
Institutional strengthening and local capacity building	Integrated regional planning	• Planning coastal resource uses for present and future generations through a long-term vision
	Conflict resolution	• Harmonizing and balancing coastal uses through coastal use zoning and clear separation between private property and public domain in the coastal area
Improving awareness, participation and responsibility among all stakeholders	Public awareness	• Developing an information-education-communication system (IEC) based on a traditional village
	Participation of stakeholders	• Developing corporate environmental responsibility.
Economic empowerment of the coastal community	Community empowerment and alternative livelihood development	• Increasing appropriate coastal and marine resources • Increasing access and opportunities • Moving partnership among the local community, private sector and government
Developing environmental investments	Integrated investment	• Developing government and public-private partnership (PPP) investments in order to resolve main environmental problems
	Securing coastal resources-based industry	• Rehabilitating and conserving the beach • Restoring and rehabilitating the coral reefs
Restoration and rehabilitation of the coastal ecosystem	Ecosystem conservation for sustainable use	• Restoring and rehabilitating the coral reefs • Controlling pollution • Monitoring the beach environment
Integrated natural disaster mitigation and management	Secure public safety	• Securing public safety from tsunami disaster

A balance among these three elements is believed to generate social welfare and peace and happiness for human life.

- Holding the Sanur village festival annually every August to promote Sanur as a tourism destination. This event is organized by the private sector and local community to mobilize participation of the private sector in revitalizing cultural and coastal values in sustainable tourism development and social prosperity.

Strong law enforcement in coastal pollution control. Consistent law enforcement is one of the effective tools to reduce or minimize environmental problems. A coordinating team, consisting of government agencies, customary leader, academe and NGOs, was formed to strengthen law enforcement to control environmental pollution and ecosystem degradation. The team's efforts resulted in significantly reducing pollutant discharges, especially organic wastes, as indicated by declining concentration of BOD, phosphate, nitrate and E. coli (**Figure 5**).

Co-beneficial approach to coral reef restoration and rehabilitation. Coral reefs are the most important coastal resources in Sanur such that coral restoration and rehabilitation is always one of the priorities besides beach rehabilitation and pollution control. Control of coral reef destruction was done through strong law enforcement against destructive fishing and coral mining. A community-based surveillance group composed of fishers and other community figures was formed to support this effort. At present, destructive fishing and other illegal practices have practically been eliminated in Sanur.

In order to accelerate recovery of habitat functions as well as develop awareness and participation of the coastal community in coral reef conservation, the governments of Bali province and Denpasar municipality have been collaborating since 2003 with NGOs, the academe and the private sector in developing a coral reef rehabilitation program. The local program was adopted as a National Program on Coral Reef Destruction Mitigation, which was launched in Denpasar in December 2004 by the Minister of Marine Affairs and Fisheries. Since 2004, coral reef rehabilitation in Sanur has a common agenda among national and local governments and local stakeholders.

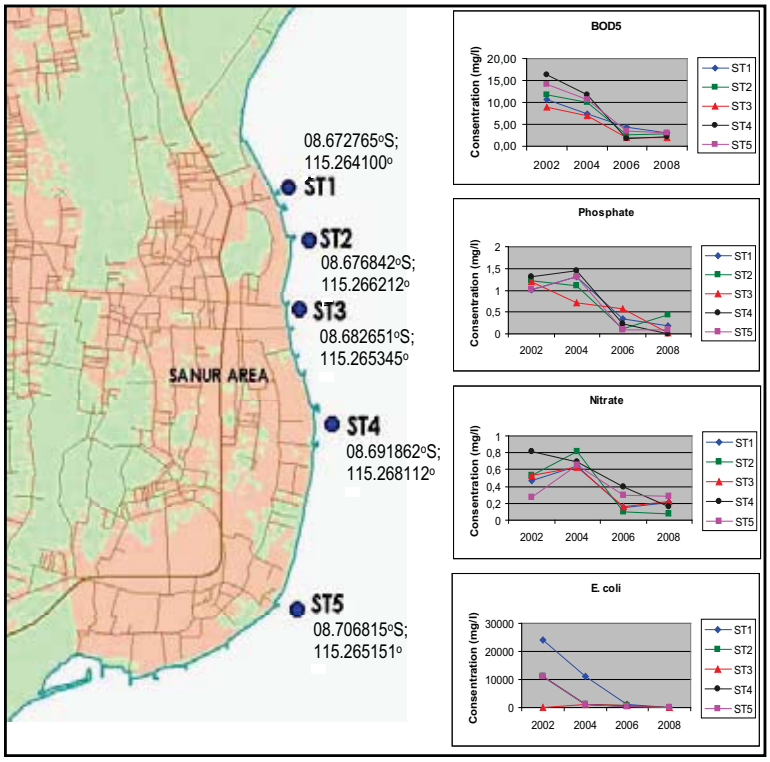
The coral reefs were rehabilitated in Sanur using the coral transplantation method and biorock. Aside from coral recovery, the rehabilitation also aimed to create new diving sites and to develop conservation tourism packages within the "Bali Reef Aware" program where tourists were willing to pay to transplant corals themselves. The co-benefit concept of this program integrated conservation with economic generation. As the coral reefs improved, the local community and private sector also benefited economically.

To empower the local community, the government and the private sector purchased corals for their rehabilitation program from the coral nurseries of communities. This served as an important incentive for the fishers group. Trained fishers also served as guides within the Bali Reef Aware Program, managed by the private sector.

Coral reef monitoring was also done annually by the government of Denpasar. Four permanent monitoring sites were maintained along the beach. Line intercept transect (LIT) monitoring results showed that the coral reef conservation program during the last ten years was successful, as indicated by the increasing live coral cover in all the sites (**Figure 6**).

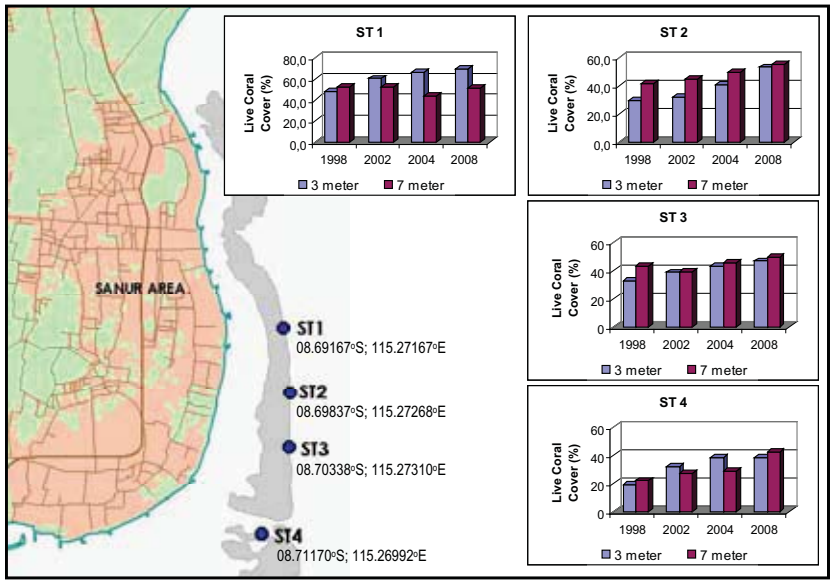
Economic empowerment. A collaboration program on economic

Figure 5. Key parameters of seawater quality in Sanur.



Reference: Environmental Management Board of Bali Province 2002, 2004, 2006 and 2008.

Figure 6. Live coral cover in Sanur area, 1998–2008, as monitored using the LIT method.



Reference: Environmental Management Agency of Denpasar, 2002-2008.

empowerment of the coastal community was launched in 2003 by the national, provincial and local governments and NGOs. The objectives of the program were as follows:

- To develop the capability of the coastal community through the development of economic activities, improvement of human resources, community participation, and strengthening of capital and economic institutions;
- To enhance the capability of the coastal community to manage and use coastal resources optimally in accordance with sustainable development principles; and
- To motivate the coastal community to forge partnerships with the private sector and government.

There were three organizations in the economic empowerment program:

- Government: The Department of Marine Affairs and Fisheries, an agency of the local government responsible for facilitating, developing, implementing, monitoring, and evaluating the program.
- Consultant: The Regency's Management Consultant which included a village associate team appointed to assist the government with program implementation by serving as facilitator, motivator, administrator and catalyst.
- Community's economic institution: the Community User Group and the Economic Institution for Coastal Development (EICD), which manages the fund from the government and the revolving fund.

Within the program, economic activities particularly those related to coastal and marine resource uses, such as fishing, fish culture, fish processing and others that support fishery activities are developed. The economic activities and capital development used the benefit accumulation and revolving (BAREV) model for sharing benefit combined with the revolving fund. Funds are facilitated by the government through the national and local budgets and managed by the EICD.

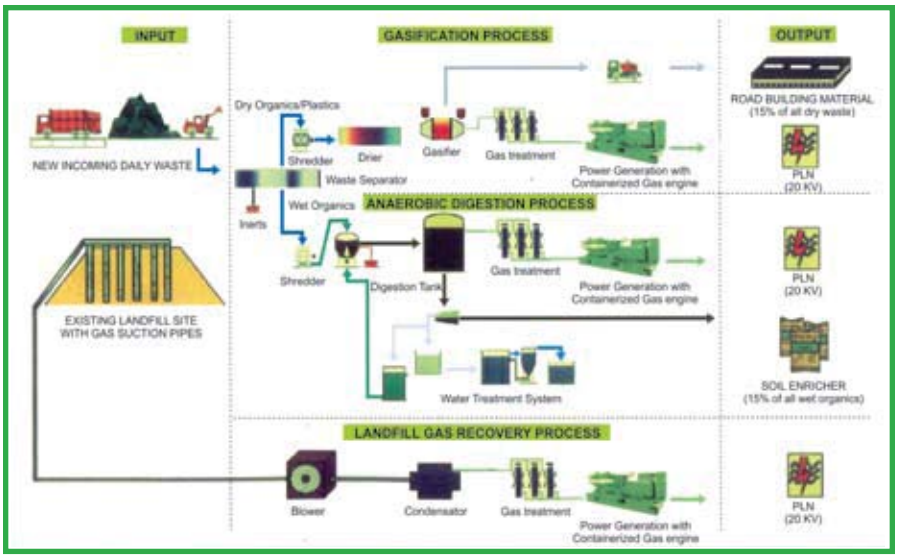
Several alternative livelihoods for households were developed through the skills improvement assistance from the village associate team. These included seaweed culture, fish processing, setting up of a small community-owned shop for fishery products, and marine tourism, among others. The local community also had more opportunities to access capital from the EICD.

Investments on Environmental Management

The approach to government investments on environmental rehabilitation and pollution control was integrated, comprehensive and holistic. Since the problems on deterioration of ecosystem, beach erosion and pollution were considered linked with one another, some investments in environmental management in Denpasar included:

1. *Government investment on rehabilitation and conservation through the Bali Beach Conservation Project (2002–2004)*. Through this program, the 6-km long eroded beach area in Sanur was rehabilitated using a combination of hard and soft structures. The hard structures included new and planned groins and breakwaters, which were constructed after demolishing private ones. The soft structures included sand nourishment, setback line provision and beach vegetation. Since the project completion in 2005, the Sanur beach has become more beautiful.
2. *Government investment on domestic wastewater through the Denpasar Sewerage Development Project*. Construction of the sewerage treatment plant, which has a capacity of 51,000 m^3/day began in 2005 and operation started in 2008. The sewerage system transfers wastewater generated in

Figure 7. Scheme of GALPHAD technology for garbage processing.



Reference: SARBAGITA Project.

households, hotels and other sources to the treatment plant through sewers and pumping stations. An aerated lagoon system is used in the treatment process.

3. *PPP approach in the investment on solid waste management*. The present development of the integrated solid waste management plant is a collaboration among four regencies/municipalities/city in the south of Bali, called SARBAGITA (Denpasar Municipality and Badung, Gianyar and Tabanan Regencies). The plant is developing a garbage processing system that will use the gasification, landfill and anaerobic digestion (GALFAD) technology (**Figure 7**).

Integrated Disaster Impact Mitigation and Management

The Denpasar government and the community in Sanur has been developing a coastal disaster impact mitigation program since 2005. This program is a systematic effort to prevent or minimize risk and to increase disaster resiliencies through both structural and nonstructural activities. The program was developed based on the awareness that the Denpasar coastal area is highly vulnerable to coastal hazards in terms of the physical infrastructural, socioeconomic, demographic and institutional aspects. ICM approaches were used to reduce the risk of disasters through strategic actions to increase resiliency in these aspects.

Several actions have been taken up in the coastal disaster mitigation program, as follows:

a. Institutional aspects

- *Development of the Strategic Plan of Disaster Mitigation and the Regional Action Plan*. Strategic planning is the key to the entire integrated planning and management process for disaster mitigation as it provides the justification and lays the foundation for disaster mitigation through the ICM Program. The common vision is a disaster-aware, safe and resistant Denpasar. The mission is to minimize the impact of emergencies and disasters on the people, property, environment, culture and economy of Denpasar. The Regional Action Plan spells out the goals, objectives, outcome indicators and impacts, locations of activities and timeframes. Some 211 action plans have been formulated for implementation by the local government and stakeholders.

Public Works of Bali Province

Beach rehabilitation and conservation in Sanur.

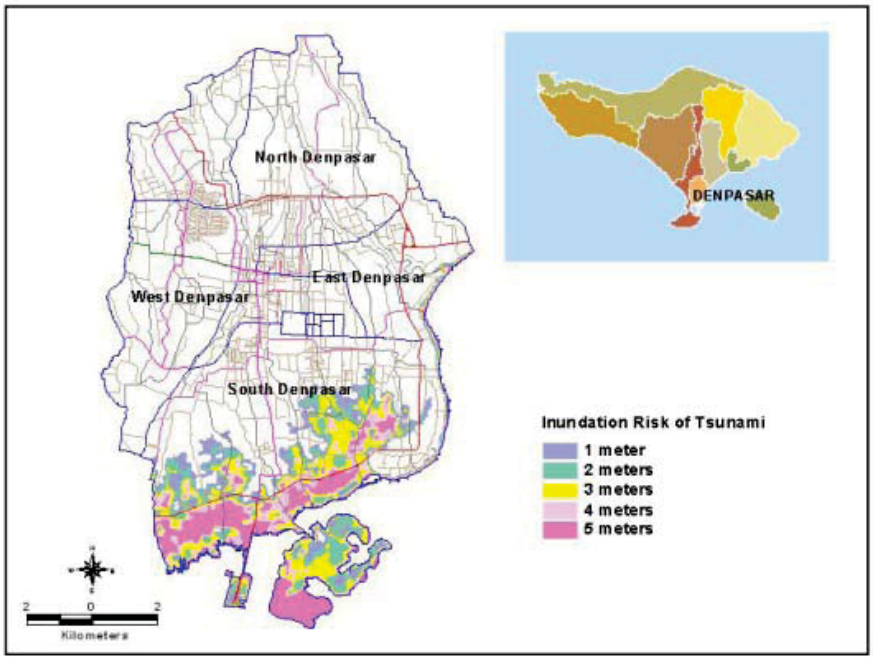
- *Preparation of micro-zoning maps of disaster-sensitive areas*. The maps are the most important information for the disaster impact mitigation program. The geographic information provides a basis to calculate the area's mappable impacts.
- *Organizational strengthening*. A strong disaster impact mitigation and management program needs a strong government organization. At present, Denpasar is one of the regencies/municipality in Bali Province that has a special coordinative disaster management institution in the form of a Disaster Management Board.
- Organization of Save Community, an organization of information services (call centers) and emergency response units (mobile emergency services).
- Establishment of a disaster task force unit in each subdistrict.
- Development of an early warning system, including one that is based on the traditional wisdom of the local village, and a regional early warning system controlled directly by the Regent.

b. Sociocultural aspects: Building a traditional village-based disaster preparedness program and undertaking necessary campaign, education, training and simulation activities.

c. Physical aspects

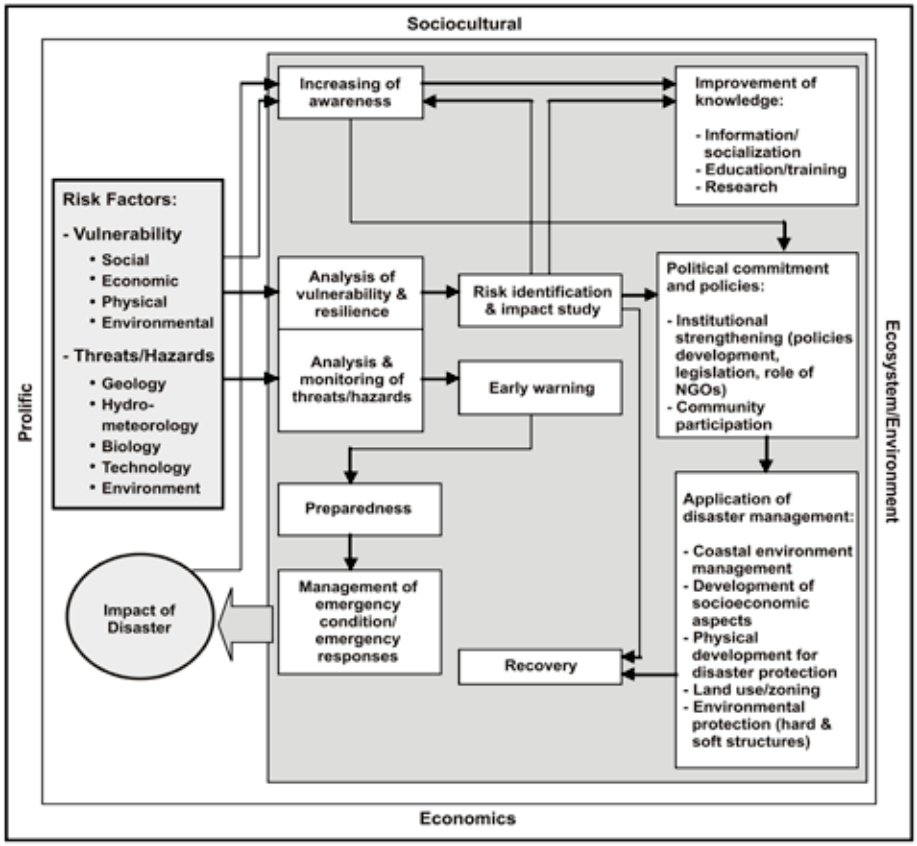
- Installation of billboards along the beach with information on signs of an approaching tsunami and tips for securing oneself from hazards
- Building and determining evacuation lanes, signs and evacuation sites in the entire area.
- Planting along the beach, and identifying buildings in the area, which can serve as evacuation sites during disasters.
- Building a siren tower as part of the early warning system.

Figure 8. Tsunami-sensitive areas in Denpasar.



The above efforts were undertaken through the strong commitment of the local government and various stakeholders. Implementation is supported by a network that aims to harmonize collaboration and communication among stakeholders.

Figure 9. Flowchart of the concept of disaster.



Constraints and Best Practices

Constraints

- The autonomy and decentralization concept in governance since the year 2000 provided a good momentum and foundation for implementing ICM. However, decentralization was not followed by rapid changes from the old development paradigm to the new one, from a sectoral orientation to an integrated one, and from a project orientation to a program one. Furthermore, understanding of the regional autonomy on coastal and marine affairs was not well developed yet among the local governments.
- The lack of capable human resources was caused by staff policies, which did not consider competency, as well as by inadequate training programs on skills improvement.
- The economic (tourism) crisis from 1998 to 2006 influenced the low capability of the government to finance environmental programs as well as the lack of corporate social responsibility of the private sector.

Best Practices

- ICM approaches were used to develop programs on beach and coastal ecosystem conservation in Sanur, Denpasar municipality. The programs were fully supported by the stakeholders. The involvement of the local community in the programs was facilitated through the empowerment of the traditional villages.
- The co-benefit concept and approach on ecosystem restoration and rehabilitation were used to mobilize the local community and private sector to participate.
- Strong and consistent law enforcement was utilized for pollution control in the coastal waters.
- Strong policies and commitment of the Regent accelerated the implementation of the ICM program in Denpasar.

A siren tower for a tsunami early warning system

References:

Dahuri, R. 2002. "Building Partnerships and Integration for the Coastal and Marine Resources Management in Indonesia." Paper presented during the Third National Conference on Coastal and Marine Resources Management in Indonesia, Sanur, Bali, 21-24 May 2002.

Diposaptono, S. 2007. "Tsunami Disaster Mitigation." Paper presented at the Natural Disaster Impact Mitigation conference in Denpasar, Sanur, Bali, 14-15 April 2007.

Environmental Management Board of Bali Province. 2008. State of the Environment of Bali Province 2008. Denpasar, Bali.

Environmental Management Board of Bali Province. 2002. Initial Environmental Risk Assessment of Southeastern Coast of Bali Province. Denpasar, Bali. Published as: PEMSEA and Bali PMO. 2004. Southeastern Coast of Bali Initial Risk Assessment. PEMSEA Technical Report No. 11. 100 p. Bali Project Management Office, Denpasar, Bali, Indonesia and Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Quezon City, Philippines.

Environmental Management Board of Bali Province. 2004. State of the Environment of Bali Province 2004. Denpasar, Bali.

Environmental Management Board of Bali Province. 2006. State of the Environment of Bali Province 2006. Denpasar, Bali.

Environmental Management Board of Bali Province. 2002 to 2008. Water Quality Monitoring Results in Bali. Annual Report. Denpasar, Bali.

Environmental Management Agency of Denpasar Municipality. 2002 to 2008. Coral Reef Monitoring Results in Denpasar. Annual Report. Denpasar, Bali.

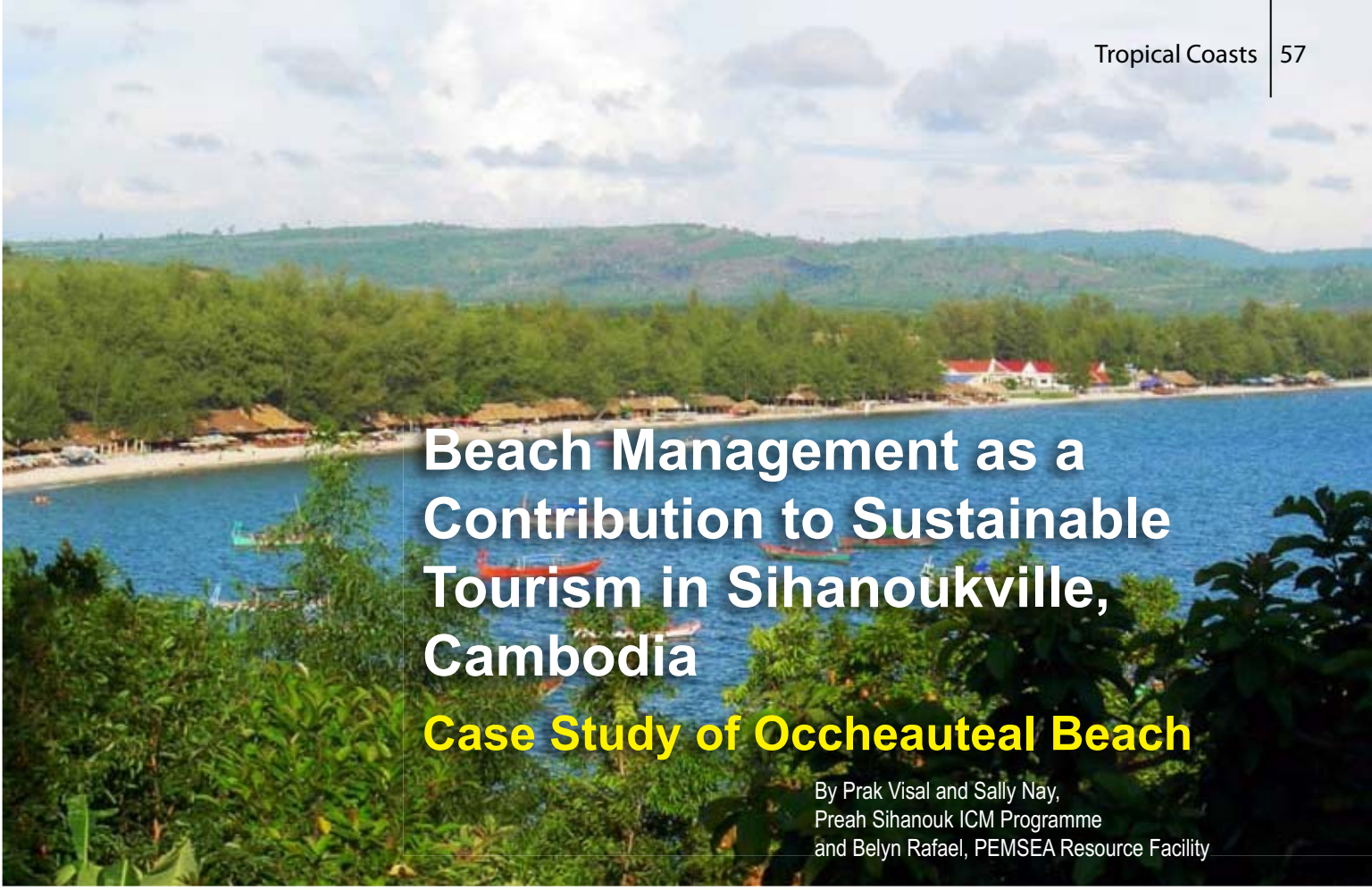
Government of Denpasar Municipality. 2007. Strategic Plan of Disaster Mitigation and the Regional Action Plan for Denpasar Municipality 2008 – 2012. Denpasar, Bali.

Meteorology and Geophysics Agency of Denpasar Regional III. 2007. "Distribution of Earthquake Centered in PGR Regional III in 2007." Denpasar, Bali.

Statistics of Denpasar Municipality. 1991 to 2008. Denpasar in Figures. Denpasar, Bali.

Sudiarta, K. 2000. Coral Reef in Bali. Warmadewa University. Denpasar, Bali.

Images:
Public Works of Bali Province. 2008. Arial photograph of Sanur Beach, Bali Beach Conservation Project. Denpasar, Bali.



Beach Management as a Contribution to Sustainable Tourism in Sihanoukville, Cambodia

Case Study of Occheauteal Beach

By Prak Visal and Sally Nay,
Preah Sihanouk ICM Programme
and Belyn Rafael, PEMSEA Resource Facility

Introduction

Preah Sihanouk commenced the development and implementation of integrated coastal management (ICM) in 2001. As one of the three economic centers in Cambodia, ICM was considered as an opportunity to sustainably manage its coastal and marine resources amid rapid urbanization in the Province. Sihanoukville harbors the only deepwater port in the country, thereby attracting several development activities, and subsequently, more people seeking employment. The estimate annual income per capita is US$ 700 per annum in 2012 and the annual population growth rate is two percent, the highest among coastal provinces in Cambodia (Department of Planning Preah Sihanouk, 2012).

Three major areas of concerns have been identified in the Province's Coastal Strategy and Implementation Plan:

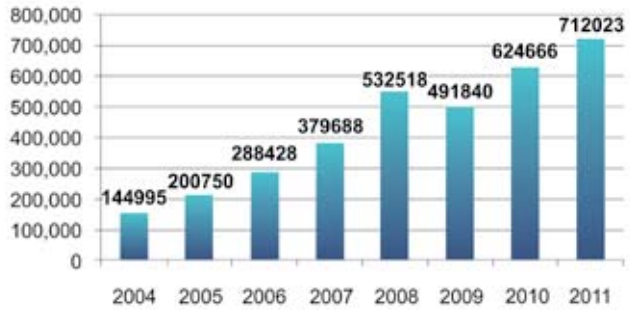
1. Pollution reduction and waste management;
2. Food security and livelihood management; and
3. Habitat protection and management.

To address these concerns, pilot projects were implemented under the ICM program from 2004 to 2008 using several ICM tools. A major tool used in addressing these three major concerns is coastal use zoning, which was developed by the province in 2004 and adopted by the National Coastal Steering Committee in May 2005. Tourism, which is affected by the three priorities identified in the Coastal Strategy (i.e., pollution, livelihood management and habitat protection), is a major area of concern in Sihanoukville. Between 1993 and 2003, domestic visitors to Sihanoukville increased from 4,585 to 83,888 and foreign tourists from 8,428 to 33,604 (Libosada, 2004). By 2011, there were more than 700,000 domestic

Table 1. Basic Information: Preah Sihanouk Province.

Location:	230 km southwest of Phnom Penh
Coastline:	140.5 km and the islands 32 km
Land area:	2,536.68 km^2 and Density: 230/km^2
1 Municipality:	Sihanoukville
3 Districts:	Prey Nop, Stung Hav, Kampong Seila
Population:	196,645 with a 2% annual increase
Employment:	19, 613 (11,162 are women)
Source Income:	Factory, agriculture, port development, fishery, business services and tourism establishment
Poverty:	21.5% (2008)
Income Sources:	Agriculture (forestry, fisheries), tourism industry, port and harbor, and oil exploration

Figure 1. Tourist arrivals in Preah Sihanouk from 2004–2011.



and foreign visitors (**Figure 1**). The seven major beaches and islands are the main tourist destinations in the province with the majority visiting the Occheauteal Beach at least once during their stay (Libosada, 2004). The increase in tourist arrivals resulted in the growing number of tourist accommodations and establishments. There were only 19 hotels and guesthouses in 1993, but this grew to 46 hotels and 110 guesthouses by 2011.

Despite the welcome benefits of coastal tourism in the province, the growing number of tourists came with serious social and environmental problems, such as beach pollution and illegal construction along the beach to accommodate tourism activities. This case study describes some of these problems and how these were addressed through ICM, specifically, through a pilot project on beach zoning initiated for Occheauteal Beach in 2004. It describes the zoning process and implementation, as well as benefits, outcomes and challenges.

Pilot Project on Tourism Development and Management

The tourism development and management in Occheauteal Beach aims to address the worsening beach encroachment and to demonstrate good practices on beach management through a local government and private sector partnership. The development of a beach management plan for Occheauteal Beach was completed through a series of workshops and initial studies on the tourism dynamics and behaviour in the beach. A PEMSEA Regional Task Force[1] mission was mobilized to assist the Sihanoukville ICM Program in conducting initial studies in 2004 and to facilitate a planning process for the pilot site. The results of these consultations and research were the bases for the tourism development and management plan for the beach.

The Beach Environment

At the time of the study, in 2004, the development of Occheauteal Beach was categorized into three zones: the beachfront area; the terrestrial area; and the private development area, which was separated from the beach proper by a road. Both the beachfront and the terrestrial areas were owned by the government, while the private development area was a mix of hotels and guesthouses, owned and operated by private entities. **Table 2** shows the growth in the number of accommodations in Occheauteal Beach from 2004 to present. Non-permanent structures such as huts and stalls in the beachfront and terrestrial areas had been developed into semi-permanent structures, with concrete floorings and solid foundations. As of 2004, there are 36 stalls situated in the two locations. The stalls generated revenue from renting out the tables, chairs and other beach gear, such as floaters, as well as preparing/selling food and drinks.

The focus of the zoning plan was on the beachfront and the terrestrial areas as these are public lands and the location of much of the informal infrastructure. At the time of the study, it was noted that there was very little effort to maintain the quality of Occheauteal

Table 2. Accommodations in Occheauteal Beach.

Accomodation	Number of Units		Occupancy Rate (Percentage)		
	2004	2012	Lean Season	Peak Season	Holidays
Hotel	6	12	40	60	90–100
Guesthouse	23	24	40	75–80	100

[1] Mr. Carlos Libosada of the Asian Institute of Tourism at the University of the Philippines spearheaded the consultation and planning process for the Occheauteal Beach. It was through this RTF mission that the zoning scheme described in this case study came about.

Photos taken prior to the start of the project in 2004.

Erosion necessitated the use of sand bags that render the spot unsightly.

An outflow pipe from a stall, built right in the middle of Occheauteal Beach.

Improvised toilets and water containers.

Wastewater discharging onto the ground surface.

Beach, both for environmental protection and tourism sustainability. The huts/stalls were not well placed, or spaced. Most of the huts were situated in the beach area; the terrestrial area primarily served as a parking lot, temporary storage area for garbage deposit, and location for improvised toilets.

Site visits further confirmed the lack of sanitation or wastewater disposal system, which caused unsightly and unhealthy conditions along the beach. Some toilets were situated very near creeks that empty into the beach area. Wastewater pipes were also placed right on the beach area, significantly affecting the aesthetics of the beach. Proper wastewater disposal facilities were absent in some establishments, with wastewater discharging directly to the ground surface.

Tourist Behaviour

Before the implementation of the pilot project, stall owners observed that most tourists visiting the province were backpackers who were staying only for a few days. Local tourist operators also observed that most tourists visited Sihanoukville as a gateway to either Thailand or Vietnam, and not as a main tourist destination. This consequently limited the duration of stay and spending patterns among tourists. Visitors only stayed for maximum of two days, or for the duration of public holidays.

Tourism Plan

Based on these findings and observations, a comprehensive tourism development and management plan was designed for Occheauteal Beach (**Figure 3**) to address environmental concerns, promote the Occheauteal Beach as a primary tourist destination and entice more international and local visitors.

The zoning aspect of the tourism plan was the major foundation for beach management. It provided a rationale approach to managing the beach area by: ensuring that the correct infrastructures and facilities were situated in the right places; maintaining beach integrity; and, at the same time, improving facilities and services for visitors to the beach. It was recognized that with the increasing number of visitors, the beach terrain would become much more vulnerable if necessary measures were not set in place. The zoning considered the projected increase in number of tourists by setting the distance of easement zone from 20 to 30 meters. This would allow more people to use the beach for recreation while preventing erosion due to infrastructure development.

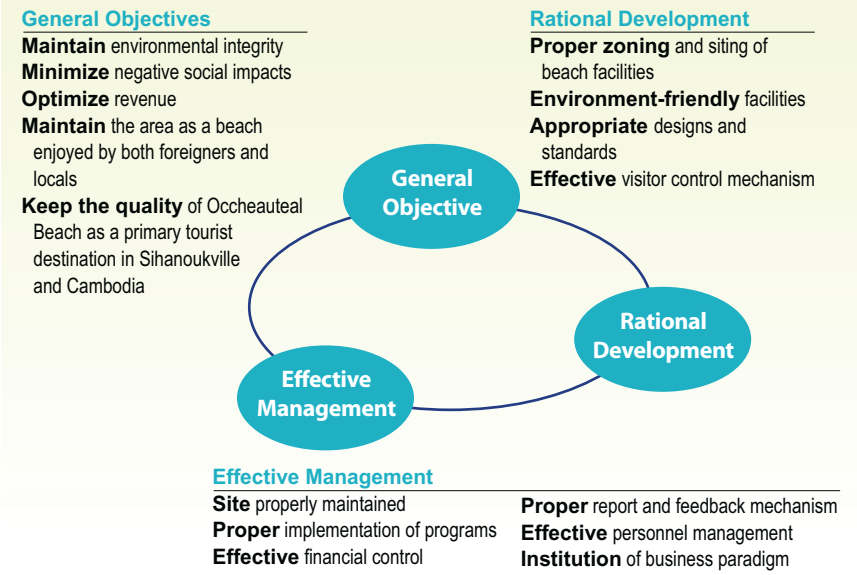
The preparation and implementation of the pilot project was undertaken by a Task Team headed by the Department of Tourism, under the ICM Project Coordinating Committee (PCC). A member of the Regional Task Force member was mobilized to assist in the planning process and provide recommendations for the development of the beach.

The project was supported by the issuance of a local *Deka*. The Task Team, in coordination with the ICM Project Management Office (PMO) facilitated the overall implementation of the project. PEMSEA provided technical assistance and financial support throughout the project. **Figure 4** summarizes the various activities conducted on beach management in Occheauteal for the past eight years.

Implementing the Zoning Plan

The pilot area for beach zoning was completed covering 704 meters of Occheauteal Beach. The zoning plan for the beach was composed of five major zones, as indicated in **Figure 5**.

Figure 3. Management framework for Occheauteal Beach.



Beach Zone

The beach area is a no-build zone for permanent facilities. Only facilities such as chairs and beach umbrellas are allowed in the area. **Photo 2** shows the condition prior to zoning implementation. **Photo 3** shows a significant beach area that was cleared of any structures as part of the zoning enforcement, providing more area for beach activities among tourists and reducing potential impacts of soil erosion from permanent structures and intensive human activities.

Swimming Zone

Prior to the implementation of zoning, no specific areas were devoted/marked for swimming. As a result, jetskis, boats and other water craft were parked everywhere in this area. **Photos 4-6** indicate the conditions prior to zoning.

The swimming zone was delineated for the waters extending 100 m seaward from the mean high tide. The area is kept free from any mechanized water craft in order to avoid accidents and conflicts over the use of the area. Changes that occurred after the zoning are shown in **Photos 7-9**.

Easement Zone

Prior to zoning, most establishments were located in the easement area.

Photo 10 shows the condition of the zone prior to zoning enforcement, while **Photo 11** shows the improvement in this zone.

Figure 4. Project Timeline (2004–2012).

Figure 5. Beach Zoning for Occheauteal Beach (Pilot Phase).

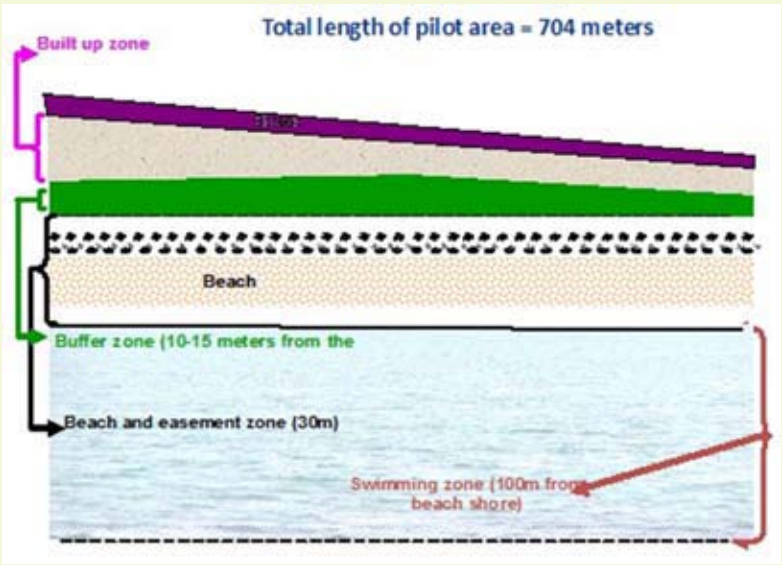


Photo 2. Beach zone before zoning.

Tourist facilities are too near the shore, causing erosion in many areas as well as pollution from solid and liquid wastes.

Photo 3. Beach zone after zoning.

A significant portion of the beach has been cleared of structures. This photo shows the beach area (green arrow), the easement (20 m–30 m, blue portion) and a part of the buffer zone (10 m–15 m, brown arrow). Only umbrellas and chairs are allowed in the beach area.

An easement zone was identified to protect the beach area from unwanted sand erosion. Due to the uneven profile of the Occheauteal Beach area, there were two easement zones: 2 m and 30 m from the mean high tide mark to 20 m to 30 m inland. The existing beach vegetation, which is part of the easement zone, were maintained and even protected to prevent sand erosion. The



Photos 4 to 6. Swimming zone before zoning.
No anchorage nor boat/jetski parking area established and tourist boats shown in the middle photo can park anywhere near the swimming area.



Photos 7 to 9. Swimming zone after zoning.
A pier was established where boats can anchor and also serves as an embarkation point for tourists. Bouys and markers were set up to identify the swimming zone.

Photo 10. Easement zone before zoning.
Concrete posts within the easement and buffer zones were established on public land along the beach.

Photo 11. Eastment zone after zoning.
The easement zone ranges from 20 m–30 m from the mean high tide mark. No permanent structures are allowed in this zone.

Photo 12–13. Buffer zone.
The buffer zone is the 10 m – 15 m transition between easement and the built-up zone. The walkway is part of the buffer zone. The trees lining up this area were maintained to prevent erosion.

Photo 14–16. Built zone.
The souvenir shop (left), lavatory (center) and a parking space beside the main road (right) were established as part of the built-up zone, which is located beyond the semi-permanent huts.

relatively narrow easement zones were recommended to accommodate the narrow builtup zone, which borders the beach, as well as consideration that the area is free from the destructive forces of typhoons.

Buffer Zone

A buffer zone of 10 meters from the easement zone was established. This was to enable existing beach vegetation to thrive and to lessen the potential impacts of development occurring in the builtup zone. Much of the human activity, moving from the built-up zone to the easement and beach zones, occurs in the buffer zone.

A walkway was established between the buffer and built-up zones to facilitate access and also to serve as a landmark for the beach area, the buffer zone and the transition between the buffer zone and the built-up area.

By creating this landmark, it was also easier to identify the beach area boundary, beyond which no permanent structures were allowed. This also allowed tourist mobility along the beach.

Builtup Zone

The open space or terrestrial area immediately beyond the buffer zone at the back portion of the beach was made part of the builtup zone. This is where much of the tourism development occurred. The builtup area was composed of two sub-areas:

a. Immediately after the buffer zone, which is composed of semi-permanent huts; and

b. More permanent facilities beyond the huts.

The semi-permanent huts (**Photos 12–13**) were built, keeping in mind the potential occurrence of erosion and other hazards. Compared to previous situation where stalls are scattered along the beach, the huts are now located in one zone and with more efficient use of beach space, there is a 52 percent increase in the number of stalls and tourist facilities over the past 4 years. The following investments were provided by the provincial government and the private sector in the built-up zone:

- Automatic wastewater facility with a capacity of 94.5 m^3 serving 39 establishments along the beach. This was completed and put into operation in 2011, reducing the discharge of wastewater to the sea;
- 74 stalls composed of semi-permanent huts and restaurants;
- Tourism information center;
- Parking space;
- Eight public lavatories;
- Two souvenir shops;
- 979 meters of walkway
- Stormwater drainage system
- Wastewater collection system and storage
- Beach signage
- Children's playground
- 74 kitchens and 91 kiosks

Table 3 summarizes facilities in the identified zones in Occheauteal Beach as planned in 2004. To date, the blue portions have been established.

The implementation of the zoning plan, however, was also challenged by several issues and will need to be continually monitored:

1. The new rules on beach zonation were met with various criticisms from stall owners as there were previously no rules and regulations

Table 3. Facilities planned and established (in black) in Occheauteal Beach.

Facility	Beach Zone	Easement Zone	Buffer Zone	Builtup Zone	Swimming Area
Beach Umbrellas	Yes	Yes	Yes	Yes	N/A
Beach Chairs	Yes	Yes	Yes	Yes	N/A
Lifeguard Tower	Yes	Yes	N/A	N/A	N/A
Beach Huts	No	No	Yes	Yes	N/A
Bar/Kiosks	No	No	No	Yes	N/A
Seawalls	No	No	No	No	N/A
Concrete Floorings	No	No	No	Yes	N/A
Garden Huts	No	No	No	Yes	N/A
Trails	No	Yes	Yes	Yes	N/A
Parking Lots	No	No	No	Yes	N/A
Toilets	No	No	No	Yes	N/A
Road for Access	No	No	No	Yes	N/A
Concrete Walls	No	No	No	No	N/A
Visitor Center	No	No	No	Yes	N/A
Shopping Center	No	No	No	Yes	N/A
Landscaped Areas	No	No	Yes	Yes	N/A
Playground	No	No	No	Yes	N/A
Septic Tanks	No	No	No	Yes	N/A
Sewage Outflow Pipes	No	No	No	Yes	N/A
Compost Pits	No	No	No	Yes	N/A
Multipurpose Activity Area	No	No	No	Yes	N/A
Waste Bins	No	No	Yes	Yes	N/A
Concrete Pier*	No	N/A	N/A	N/A	No

N/A - Not applicable
* - Separate zone established

Table 4. Partners' contribution on beach management in Occheauteal Beach.

Description	Partner's Contribution		
	Government fund	Private Contribution	PEMSEA Support
Preparation, mobilization and masterplan			21,000.00
Infrastructure improvement	235,146.70	613,453.00	20,000.00
SUBTOTAL	235,146.70	613,453.00	41,000.00
Total investment made to date			889,599.70

aside from the payment of tariff on the use of the public land (beach area); stall owners were apprehensive that the enforcement of the zoning scheme would not be applied to everyone;

2. Stall owners needed to remove their semi-permanent structures and invest in new structures; the investments were costly and without any guarantee of return; and

3. There would be temporary loss of livelihood during the construction period.

The implementation of the zoning scheme was initiated in 2008 with the construction of lavatories and parking spaces. This was seen as a way to demonstrate the local government's commitment to improve beach management and gain the trust of local business operators. Most of the apprehension has been replaced with confidence and realization of benefits.

Project Expenditures

The establishment of these facilities was achieved using public funds. Catalytic funds from PEMSEA, which were about 4.6 percent of the total project cost, were mainly used in setting up the plan and providing the wastewater facility using a revolving fund mechanism. The fund to construct the facility was provided by PEMSEA with the agreement that the Provincial Government and local businesses will have to pay for maintenance. The initial capital will be collected gradually from the stall owners starting 2013.

The government provided 27 percent of the total infrastructure development while bulk (69 %) of the expenses was contributed by stall owners. Details of contributions are indicated in **Table 4**.

Overall management of the project was the responsibility of the Task Team and the Department of Tourism, in cooperation with the stall owners and private investors.

Socioeconomic and Environmental Benefits

The zoning enforcement has improved infrastructures and beach management conditions in Occheauteal leading to an increase in income. Initial surveys with hut owners and documentation from the Department of Tourism revealed the following benefits:

a. Increased number of tourists in the province from 144,995 in 2004 to 712,023 in 2011. This provides an indicative number of tourists who are expected to visit the beach at least once in their stay in Sihanoukville. While there are a lot of factors affecting tourist arrivals, stall owners along Occheauteal said that the improved conditions along the beach may have contributed to an increase in number of visitors.The Province is also looking at developing the other nearby beaches, namely Serendipity and Otress, to disperse the tourists in Ochheauteal.

   Despite the increasing number of tourists, the water quality monitoring conducted for Occheauteal Beach from 2005–2012 also revealed that the water quality has been maintained and conforms to standards for recreational use[2].

b. Length of stay in the beach has increased from an average of two days (Saturdays and Sundays) to four days (Thursdays to Sundays) leading to an average increase of US$ 50 in the daily income per stall. Each stall owner invested about

[2] ASEAN standards for marine water quality .

US$ 20,000 in building their kitchens and huts and expect to recover their initial capital within four to five years. The increased income has instilled a sense of responsibility among stall owners on the management of the beach. A recent survey revealed that all stall owners are willing to contribute to beach management, the majority of whom are willing to provide US$ 25 to US$ 30 monthly contribution.

c. Increased number of workers. In 2004, each stall employed only three workers. This has increased to five, as indicated in a 2012 survey. The majority of stall owners also indicated an annual income of US$ 25,000 to US$ 30,000. Previous discussions prior to project implementation in 2004 revealed that the stall owners earned less than US$10,000 to US$15,000 per year.

d. Positive demonstration. Encouraged by the progress made on beach management, the nearby stall owners have taken on Occheauteal as a model in beach management. About 35 stalls in Serendipity beach voluntarily moved away from the beach. The government has also invested in improving the road access and lighting in this beach. Improvement on road access to adjacent Otress beach is being considered by the government as part of the beach management expansion. Initial consultations with stakeholders in this beach indicated their willingness to be part of the zoning process.

e. Strengthened government and private sector participation particularly in the built-up zone as the project relies on the voluntary contribution of family owners in establishing their stalls. The private sector also looks at government investment for infrastructure such as roads, parks, toilets, waste treatment and others. In interviews with stall owners, commitment from the government is very important in generating support from local business operators. Most of them feel "secure" knowing that the government will do its part and fulfill its role in the implementation process.

f. Greater political commitment to coastal management. Having demonstrated its capacity to manage Occheauteal beach, the Province applied to be a member of the Club of the Most Beautiful Bays in the World *(Les Plus Belles Baies Du Monde*, based in Paris, France). While the initial application included only Preah Sihanouk, the Government has amended its application to include the Cambodian Bay covering all four provinces. Its membership was approved on 25 May 2011, drawing attention from the national government to consciously consider the coastal and marine resources in the development planning for the country. Its membership also resulted in several policies on coastal management and institutional arrangements to promote sustainable development of coastal areas, such as the Circular on the Development of Coastal Areas in the Kingdom of Cambodia (policy) and the Decision on the Establishment and function of Committee for Management and Development of Cambodia's Coastal Area in Preah Sihanouk.

Significant Learning from Implementation and the Way Forward

In the course of implementation, there were several significant realizations. These include the following:

1. Limited information should not restrain progressive action. Information can take on various forms to enable effective management. In 2004, there was not enough information on the erosion rate and other scientific information as bases for zoning the beach. One of the proxy indicators used was the observed rate of erosion in nearby Otress Beach, which is adjacent to Ochheauteal Beach, wherein about a meter of beach is lost every year . This was used as a benchmark and basis in convincing the stall owners to move farther from the beach. Moving permanent structures away from the beach also protects investment from any potential damage caused by beach erosion.

2. Zoning is both a technical and a political exercise that requires a good understanding not only of the environmental aspects but also the socio-cultural setting. This pilot project was implemented in less than a kilometer of beach area faced with several challenges including existing illegal structures in the easement zone. Dialogues and information campaigns were conducted over a four-year period before the zoning could be fully implemented and enforced. Developing a zoning plan alone does not guarantee effective implementation. The process of consultations and negotiations should be seen as opportunities for education, emphasizing in the process and the long-term economic potential of effective beach management.

   Part of the agreement between the government and stall owners was the three-year moratorium

in the payment of land rental to the government to allow the families to recover from the initial investments.

3. Understanding and appreciation of environmental importance comes after people see concrete economic benefits from their activities. Compared to initial negative perception of the zoning, the recent survey indicated a strong agreement and support on implementation and appreciation among stall owners.
4. Public-private partnership is the key and getting buy-in from stall owners is important in the absence of government funds for infrastructure development.

While this project has shown significant socioeconomic benefits from effective management, it still needs further work to expand implementation, and to address specific issues on:

a. Organizing the stall owners and informal vendors and further improving their skills to provide better services to tourists. There is also an urgent need to increase awareness on protection of the beach.
b. Improving beach security and safety.
c. Maintenance of facilities and further landscape improvement.
d. Setting up of a sustainable financial mechanism to ensure sustainability of efforts and replication to other beaches.

The province is committed to continually monitor and improve management of the beach.

References:

ICM Program Management Office, Preah Sihanouk. Annual Report on Ochheauteal Beach Implementation and Management 2010 and 2011. Preah Sihanouk, Cambodia.

ICM Program Management Office, Preah Sihanouk. 2012. Survey on the Impact of the Implementation of the Tourism Development and Management for Ochheauteal Beach. Preah Sihanouk, Cambodia.

Han Haknouk Rith, Saut Moeun and Muth Vireak. April 2008. First Draft Report of SWOT Analysis on Tourism Development at Ochheauteal Beach and Challenges for New Tourism Development Plan Implementation. Preah Sihanouk, Cambodia.

Regional Task Force and the ICM Program Management Office, Preah Sihanouk. 2004. Tourism Development and Management Plan for Occheauteal Beach. Unpublished Report. Preah Sihanouk, Cambodia.

www.pemsea.org

PEMSEA Website features

- Revamp of main PEMSEA website in 2011. Website was revamped to a better design using a future-proof content management system.
- Country, ICM site, and organization profiles. The new website features one-stop profiles for each country in the region, PEMSEA's ICM sites, and non-country partners.
- Integrated online bookstore. An integrated shopping facility for in-print publications was created, providing a convenient shopping cart and automatic shipping cost computation
- Online payment system. The EAS Congress 2012 website featured an integrated online credit card payment facility for registration and exhibition fees.
- Microsites for streamlined information dissemination
  - East Asian Seas Congress 2009 and 2012
  - SGP-PEMSEA Communiqué ***(http://pemsea.org/sgp)***
  - Strategic Partnerships ***(http://pemsea.org/strategic-partnerships)***

Online Outreach Activities

- Social media channels. Three social media channels were opened to provide more avenues for disseminating information.
  - Publications in Scribd ***(http://www.scribd.com/pemsea)***
  - Videos in Vimeo ***(http://www.vimeo.com/pemsea)***
  - Facebook ***(http://facebook.com/pemsea)***
  - LinkedIn ***(http://www.linkedin.com/company/partnerships-in-environmental-management-for-the-seas-of-east-asia-pemsea-)***
- e-Updates. Articles from PEMSEA's online newsletter

Online Library Catalog

- System streamlining. More than 15,000 records were merged into the main catalog.
- Online catalog. The library's online catalog was made available online ***(http://library.pemsea.org)*** for the benefit of outside researchers.

PEMSEA Sites Across the Region

Over two billion inhabitants value the coasts and oceans of the East Asian Seas region as a major economic resource that provides sustenance and livelihood. The region's bodies of water are considered essential by the rest of the world because nearly 40 percent of the world's fish catch and more than 80 percent of aquaculture is produced in the East Asian Seas.

The region's unique concentration of biodiversity is exemplified in the Coral Triangle Considered as the global center of marine biodiversity, it has the most diverse marine ecosystems in the world, with more than 500 species of coral, at least 3,000 species of fish and the greatest remaining mangrove forests on Earth. This area of diverse marine flora and fauna forms a triangle that encompasses four countries in the region (dotted line in the map). Also located within the region, the East Asian-Australasian Flyway (shorebird migratory route, represented by arrows) is crossed by over five million migratory shorebirds of 55 species during their annual migration.

Unfortunately, this rich biodiversity is threatened by environmental degradation caused by unsustainable economic development in the region. These marine pollution hotspots, often in enclosed and/or semi-enclosed bodies of water like bays and river mouths that receive severe pollution loads, pose a constant threat to public health, coastal resources, and the integrity of coastal ecosystems. Pollution hotspots are commonly in coastal and marine areas in the vicinity of megacities, i.e., highly urbanized and densely populated cities home to at least 13 million people.

In response to the growing threats, international, regional and national initiatives aim to conserve and redress the loss of biodiversity through conventions, declarations and legislations that have resulted in an array of protected areas, including World Heritage Sites and Ramsar sites. These protected parks and wetlands are scattered all over the region (see white bordered squares and triangles respectively).

Developing ICM demonstration and parallel sites across the region is PEMSEA's response to the growing problem of the degradation of coastal and marine ecosystems. Through the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) and integrated coastal management (ICM), PEMSEA aims to develop a self-sustained and effective regional collaborative mechanism that can address the challenges that face the coastal and marine ecosystems . The proximity to pollution hotspots, such as the Bohai Sea, Manila Bay, Jakarta Bay, Gulf of Thailand and the Malacca Straits, is a common impetus for local governments to adopt ICM as a practical framework for sustainable development. These 31 ICM demonstration and parallel sites, along with protected World Heritage Sites and Ramsar sites enable the region to cooperatively manage their coasts and oceans and preserve regional biodiversity.

Sources:

Conservation International, The Coral Triangle Initiative, www.conservation.org/global/marine/initiatives/oceanscapes/cti/pages/overview.aspx (Accessed August 2012).

Department of the Environment and Heritage of the Australian Government. Shorebird Migration Poster. www.environment.gov.au/biodiversity/migratory/publications/pubs/shorebirds-east-asia.pdf (Accessed August 2012).

Graphic Maps. www.worldatlas.com/webimage/countrys/aslandrivers.htm (Accessed August 2012).

RAMSAR Convention Secretariat. www.ramsar.org/cda/en/ramsar-home/main/ramsar/1_4000_0__ (Accessed August 2012).

United Nations Educational, Scientific and Cultural Organization (UNESCO). whc.unesco.org/en/list

World City Information. www.city-infos.com/list-of-megacities-2011 (Accessed August 2012).