Coastal erosion and its remediation in six Southeast Asian countries

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Outline

* 1. Coastal erosion
* 2. KOICA/YEOSU project
* 3. Coastlines and hotspots
* 4. Factors
* 5. Current and planned remediation
* 6. Recommended pilot interventions
* 7. Good practices
* 8. Conclusion

1. Coastal erosion

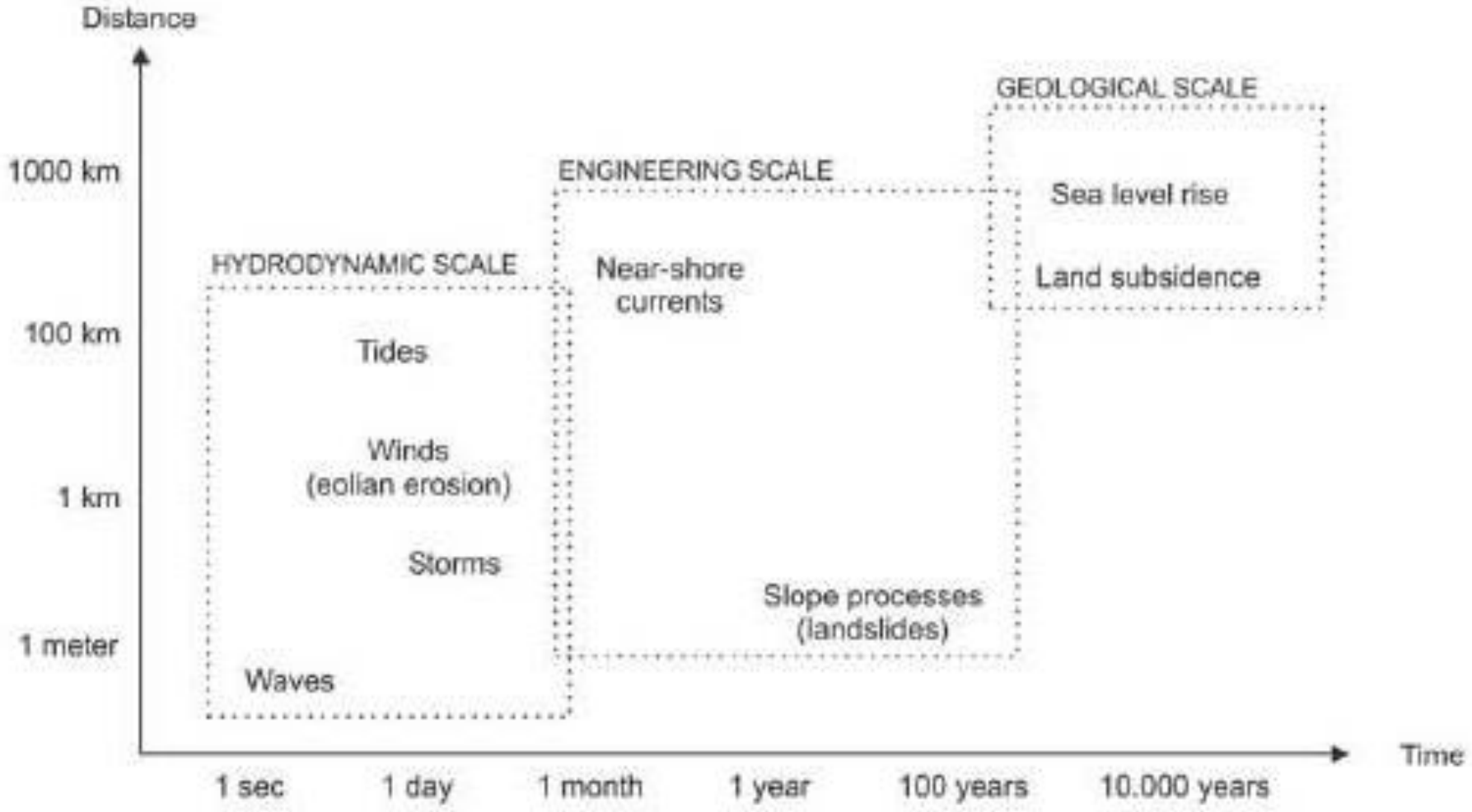
Definition

Definition

* **Wearing of land by wave action, currents or drainage.**

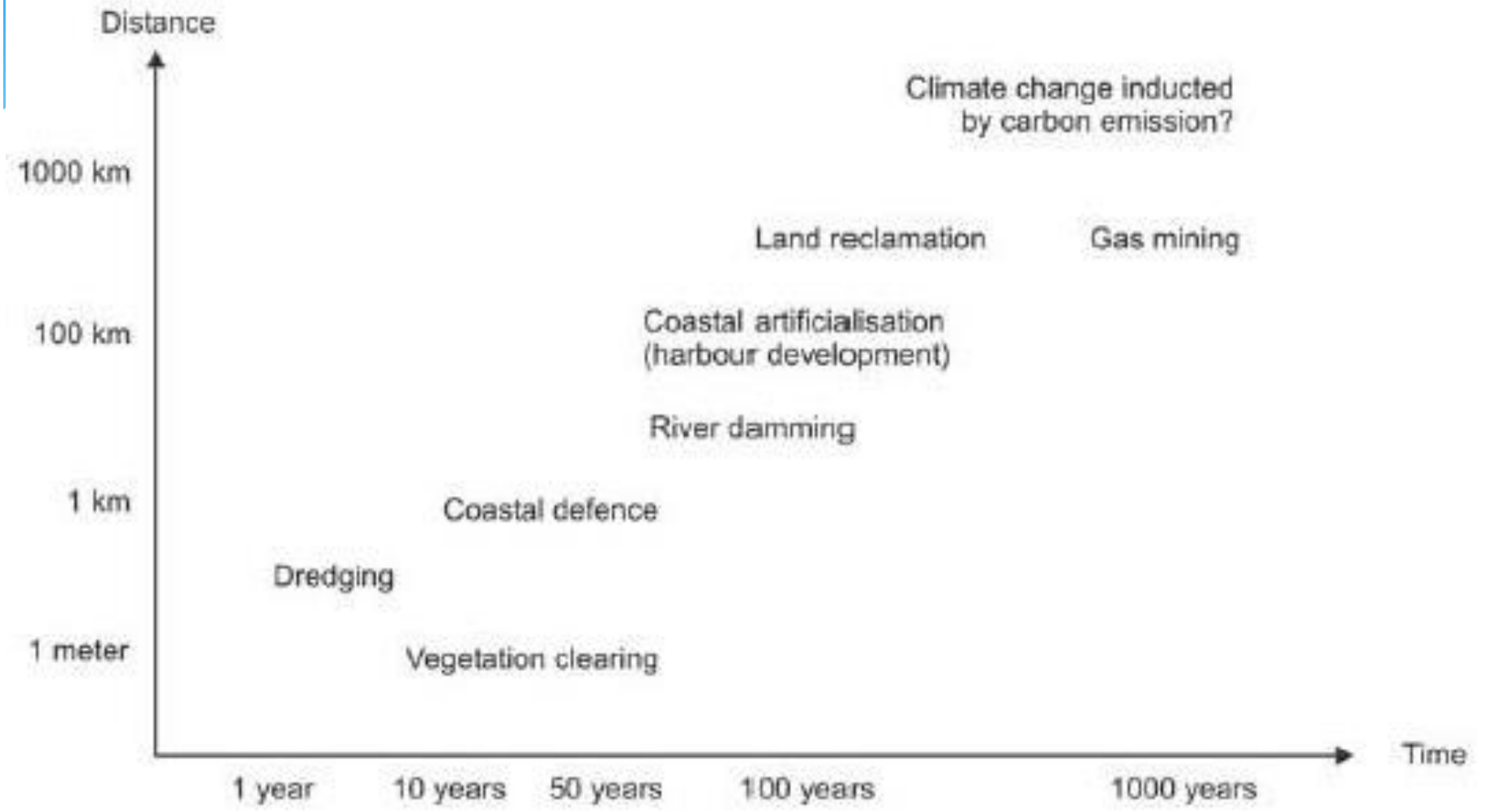
* **Results in collapsed cliffs, removal of beach & dune sediments, destruction of mangroves & other coastal forests.**

Natural factors



(EU 2004)[5]

Human factors



(EU 2004)

AR5 sea-level rise

Future sea level rise

* **RCPs (Representative Concentration Pathways) are GHG concentration (not emissions) trajectories; Four named after possible range of radiative forcing values in year 2100 (2.6, 4.5, 6.0 & 8.5 W/m^2). (In AR4, 1.6 W/m^2 , varying 0.6–2.4 W/m^2).**

* **Ocean thermal expansion & melting of glaciers account for 80% of SLR in 20th century. GMSL continues to rise beyond 2100.**

* **Regional SLR varies from GMSL up to 40 cm due to ENSO (El Niño-Southern Oscillation).**

GMSL

Emission scenario	Representative Concentration Pathway (RCP)	2100 CO_2 concentration (ppm)	Mean sea level rise (m)	
			2046–2065	2100
Low	2.6	421	0.24 [0.17–0.32]	0.44 [0.28–0.61]
Medium low	4.5	538	0.26 [0.19–0.33]	0.53 [0.36–0.71]
Medium high	6.0	670	0.25 [0.18–0.32]	0.55 [0.38–0.73]
High	8.5	936	0.29 [0.22–0.38]	0.74 [0.52–0.98]

(IPCC 2014, chap. 5)

Emission scenario	Mean sea level rise (m)		
	2200	2300	2500
Low	0.35–0.72	0.41–0.85	0.50–1.02
Medium	0.26–1.09	0.27–1.51	0.18–2.32
High	0.58–2.03	0.92–3.59	1.51–6.63

Regional issue

Issue in SE Asia

* Coastal erosion recognized as emerging threat & issue of grave concern to 10 COBSEA (Coordinating Body on the Seas of East Asia) countries.

* With support from government of Korea, developed 'COBSEA Regional Programme for the Sustainable and Ecosystem-Based Management of Coastal Erosion in the East Asian Seas Region'.

COBSEA coastal projects

* **1.1.2010 – 31.12.2014 : Objectives of projects**

* **Sida : Focus on spatial planning in coastal areas to reduce or prevent impact of natural disaster, climate change & sea-level rise & to promote sustainable development.**

* **KOICA/Yeosu : Address sea-level rise & coastal erosion in an ecosystem-based & sustainable manner, within an ICZM framework.**

* **MFF : Develop & adopt a regional strategic approach to understand vulnerability to coastal erosion & implement pilot projects to test & refine priority intervention addressing coastal erosion in Pakistan & Thailand.**

2. KOICA/YEOSU project

Project

Korea Internatioal Cooperation Agency/Yeosu

* **As initial stages of COBSEA Regional Programme in 6 developing countries, Cambodia, Indonesia, Malaysia, Philippines, Thailand & Vietnam.**

* **Two-year project : 2012-2013. Budget US$400,000.**

* **Phase 1 - producing an assessment of national & sub-national settings related to coastal erosion.**

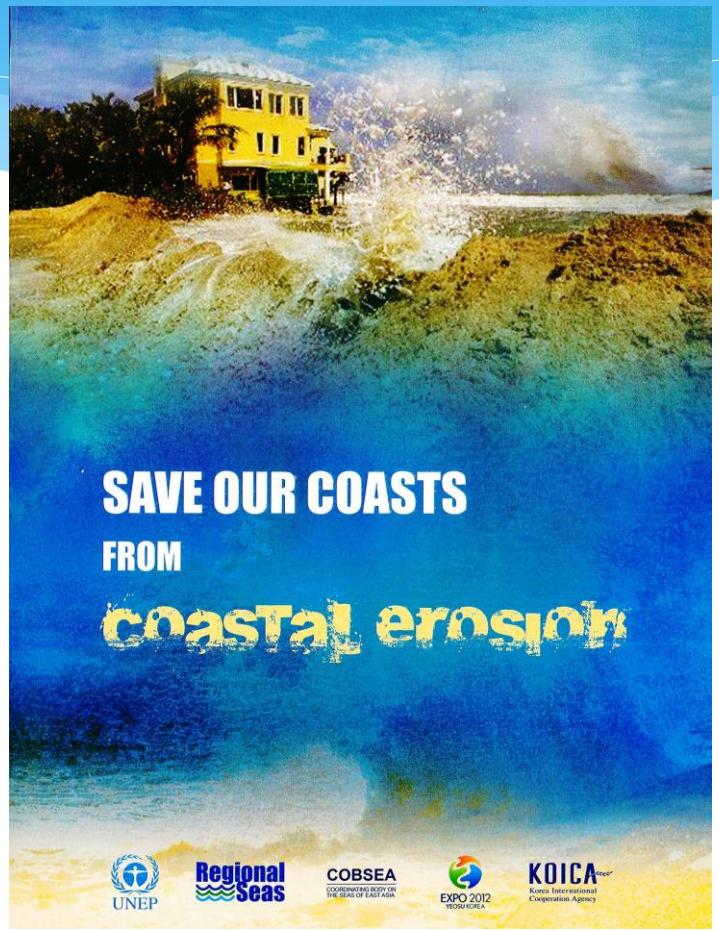
* **Phase 2 - National consultations, identification & prioritization of possible interventions.**

* **Phase 3 - Producing a 'national roadmap' for addressing coastal erosion.**

Preparatory phase

* **Regional resource notebook** **"Save Our Coasts from Coastal Erosion".**

* **General information on coastal erosion & country specific information with the objective of creating & enhancing public awareness on coastal erosion across the EAS region.**



(UNEP 2012)

Each country – project outputs

1. National Assessment Reports (NARs) - basis for identifying priority interventions & developing national roadmaps.

2. Menu of possible pilot interventions in each country.

3. Reports on country consultation & engagement meeting on the type of capacity building activities & interventions to be developed & implemented in each country.

1. Roadmap for implementation of specific pilot interventions within each country complete with workplans & budgets.

Inception meeting

* **Held in 31 July-1 Aug 2012, Bangkok, Thailand.**

* **Among various objectives to provide national teams : with knowledge base of coastal erosion, policy base of coastal erosion, gathered inputs from national teams on National Assessment Report & national consultation meeting.**

Concluding meeting

* **10-11 December 2013, Pattaya, Thailand.**

* **Present & share project accomplishments & outputs, the outcomes, lessons learned, good practices & gaps on project activities & implementation, & plans & commitments to move forward the implementation of planned pilot interventions.**

* **Identify & discuss the common lessons learned & good practices, gaps & needs to serve as inputs in the development of future regional & national projects & in the global lessons learned & good practices exchange that UNEP is promoting to implement.**

NARs

National Assessment Reports

* **Status report & an analysis of coastal erosion occurring in the country.**
* **Coastal vulnerabilities due to coastal erosion.**
* **Existing body of relevant policies, systems & institutional mechanisms addressing coastal erosion.**
* **Past, current & planned interventions.**
* **Identify gaps & needs to address coastal erosion.**
* **Road map on building capacity & recommended interventions.**

KINGDOM OF CAMBODIA
NATION RELIGION KING

NATIONAL ASSESSMENT REPORT

ON

COASTAL EROSION

MINISTRY OF ENVOIRONMENT
FEBRUARY 2013

UNEP

COBSEA

The COBSEA YEOSU Project on
Sea-Level Rise and Coastal Erosion
in the East Asian Seas

National Assessment Report of
REPUBLIC OF INDONESIA

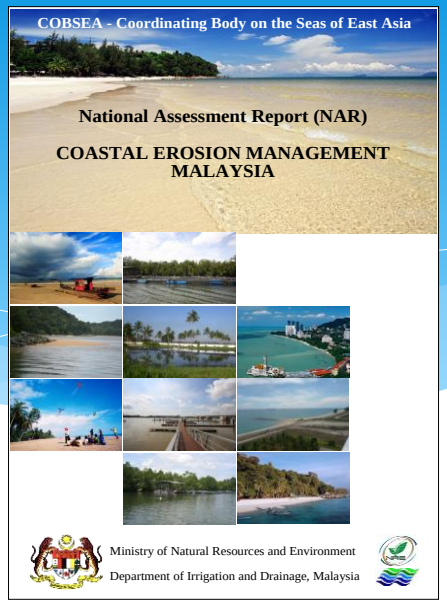
Prepared by:

Hamzah Latief

Institutut Teknologi Bandung

August 2013

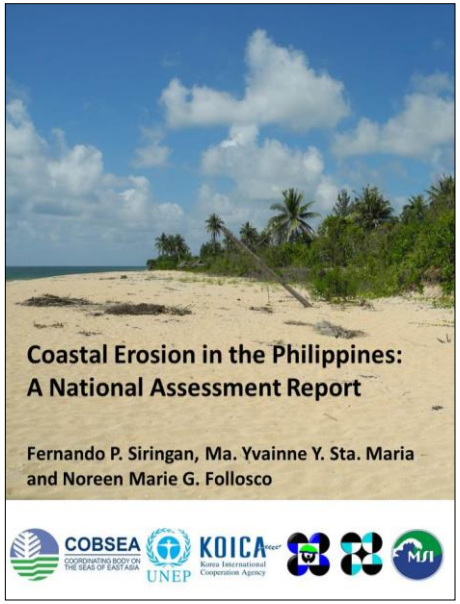
COBSEA - Coordinating Body on the Seas of East Asia



National Assessment Report (NAR)

COASTAL EROSION MANAGEMENT
MALAYSIA

Ministry of Natural Resources and Environment
Department of Irrigation and Drainage, Malaysia



Coastal Erosion in the Philippines:
A National Assessment Report

Fernando P. Siringan, Ma. Yvainne Y. Sta. Maria
and Noreen Marie G. Follosco

COBSEA
UNEP
KOICA

COBSEA
COORDINATING BODY ON
THE SEAS OF EAST ASIA

UNEP

The COBSEA YEOSU Project on Sea-Level Rise
and Coastal Erosion in the East Asian Seas

National Assessment Report:
Thailand

Prepared by

Department of Marine and Coastal Resources
Ministry of Natural Resources and Environment

and

Center of Excellence for Biodiversity of Peninsular Thailanuld
Faculty of Science
Prince of Songkhla University

December 2013

UNEP

COBSEA
COORDINATING BODY ON
THE SEAS OF EAST ASIA

NATIONAL ASSESSMENT REPORT OF

VIETNAM COASTAL EROSION

VIETNAM - 2013

3. Coastlines and hotspots

Coastlines

* **Cambodia : 435 km covering four provinces: Koh Kong, Kampot, Sihanoukville, & Kep.**
* **Indonesia : 95,181 km, archipelago of 17,480 islands (6,000 still uninhabited).**
* **Malaysia : 4,809 km in Peninsular Malaysia & East Malaysia.**
* **Philippines : 36,289 km, archipelago of 7,107 islands.**
* **Thailand : 3,148 km facing Andaman Sea (1/3, 6 provinces), Gulf coast (2/3, 17 provinces).**
* **Vietnam : 3,200 km, almost all facing high-energy South China Sea.**

Hotspots - Cambodia

- Erosion identified along all 4 coastal provinces.

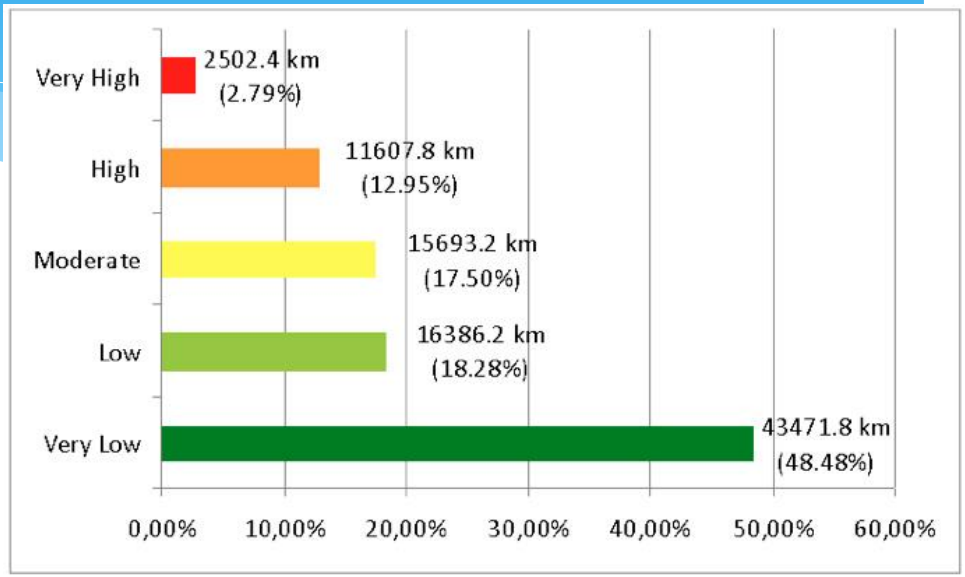



Hotspots - Indonesia

* Observations focused mainly areas with high economic value, tourist coasts or industrial locations.

* Around 35% of total length of Indonesian coasts have experienced a moderate, high & very high erosion rate. 16% experienced a high & very high erosion rate.

* Mainly in Aceh, North Sumatra, West Sumatra, Riau, Bengkulu, Lampung, Banten, West Java, Central Java, East Java, Bali, Nusa Tenggara Burat, West Kalimantan, East Kalimantan, North Sulawesi, South Sulawesi, Maluku & Papua.



Hotspots - Malaysia

* Three categories of coastal erosion – I, critical (imminent danger); II, significant (endangered within 5-10 yr); & III, acceptable.

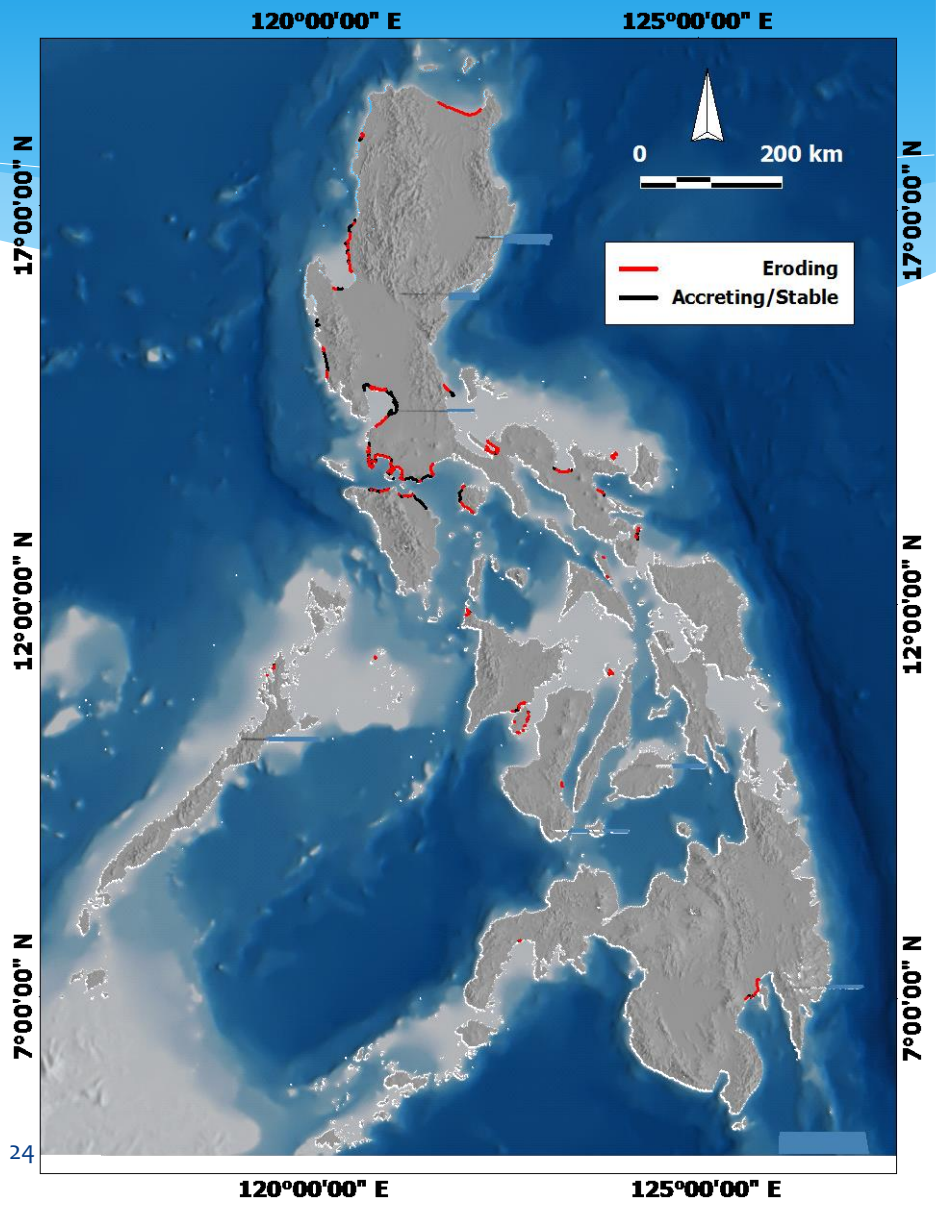
* 29% facing coastal erosion. East coast of Peninsular Malaysia with several areas in state of Terengganu, Tanjung Piai (Johor) & Miri (Sarawak in East Malaysia).

© C.H. Lim

Hotspots - Philippines

* **10% surveyed; mainly in Luzon. About 50% of areas mapped is experiencing erosion of varying rates in the past 30 years.**

* **Coastal erosion is prevalent & severe in many places but not yet recognized as a national issue.**

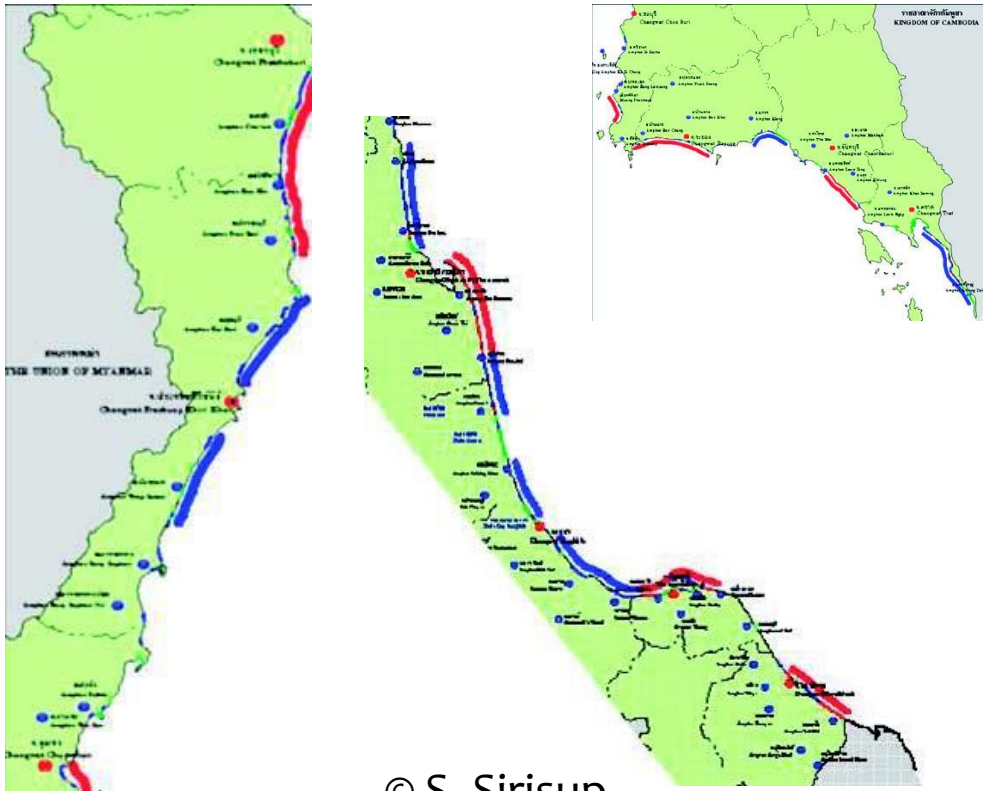


(Philippines NAR)

Hotspots - Thailand

* High-risk (>5 m/yr) & moderate-risk (1-5 m/yr) locations identified for Gulf of Thailand & Andaman Sea.

* 11.10% of coastline in Gulf of Thailand & 2.29% of coastline of Andaman Sea are severely eroded – erosion rate of > 5m/yr. Equivalent to 2 km² of coastal real estate.



© S. Sirisup

Hotspots - Vietnam

* Numerous locations in provinces of North, Central & South region. Common & serious along entire coast.

* 1,400 km of coastal dikes & 1,400 km of estuarine dikes constructed.

Coastal erosion - summary

Summary

* **Serious threat in all six countries.**

* **Widespread along Vietnamese coast & in Cambodia.**

* **Severe erosion to very severe erosion in ¼ to 1/3 of coastlines. In Philippines where 10% have been surveyed, about ½ are eroding.**

4. Factors

Factors – Cambodia & Indonesia

* **Cambodia : Human factors have been significant; increasing development activities, mangrove & land encroachment are the root cause of coastal erosion.**

* **Indonesia : Coastal erosion started significantly in 1970s, especially on north coast of Java due to mangrove deforestation & conversion to fish ponds. 1980-2000 : mangrove land conversion activities spread to west coast of Sumatra, south & east coast of Kalimantan island & almost the coast of South & Southeast Sulawesi provinces. Tectonism is important factor with erosion associated with earthquakes, volcanic eruptions, land subsidence & compaction & tsunamis.**

Factors – Malaysia & Philippines

* **Malaysia : Much of this erosion occurs naturally & not caused by human intervention. Major human cause is due to development activities on the coastline or coastal zone that are not properly planned or sited.**

* **Philippines : Primarily due to a deficit in sediment supply; exposure to typhoons & storm surges.**

Rompin


Upland
Fresh water swamp
Beach ridges
Mangrove
KUALA MERCONG
SOUTH CHINA SEA
N
LANJUT


SEBAYAN
SUMMERSET
DRIFT
OUTLET BLOCKED
SUMQ1
EROSION
SKETCH
CHALETS
RESORT
PERMATANG
TREATMENT PLANT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Factors – Thailand & Vietnam

* **Thailand : caused by natural causes; human factors, particularly destruction of mangrove forest for shrimp farming or other land use has been a major factor; others include land development, construction of infrastructure, reclamation & dredging.**

* **Vietnam : exposure to high waves, typhoons & storm surges. Specific human factors include depletion of mangroves by aquaculture, beach sand mining, removal of reefs for construction & construction works on rivers.**

Pattaya

Hoi An

Factors - summary

* **Natural factors : Philippines and Vietnam exposed to typhoons & storm surges. Vietnamese coast is exposed to high waves. Indonesia to effects of tectonism including tsunamis, volcanic eruptions, landslides, etc.**

* **Human factors : Variety of human factors. Destruction of mangroves mentioned by Cambodia, Indonesia, Philippines. Others include : reclamation, industries, tourism, dam construction, beach mining, etc.**

SLR (1)

Sea level rise

* **Problem of attribution**

* **Cambodia : SLR is another factor contributing to coastal erosion.**

* **Indonesia : Based on tidal data from several tide stations in Indonesia an upward trend in sea level of 40-70 cm is expected by 2100.**

* **Malaysia : No detailed assessment on SLR; based on the observed (local) scenario at the tip of Peninsular Malaysia, sea level is expected to rise to 0.5 m in 100 years.**

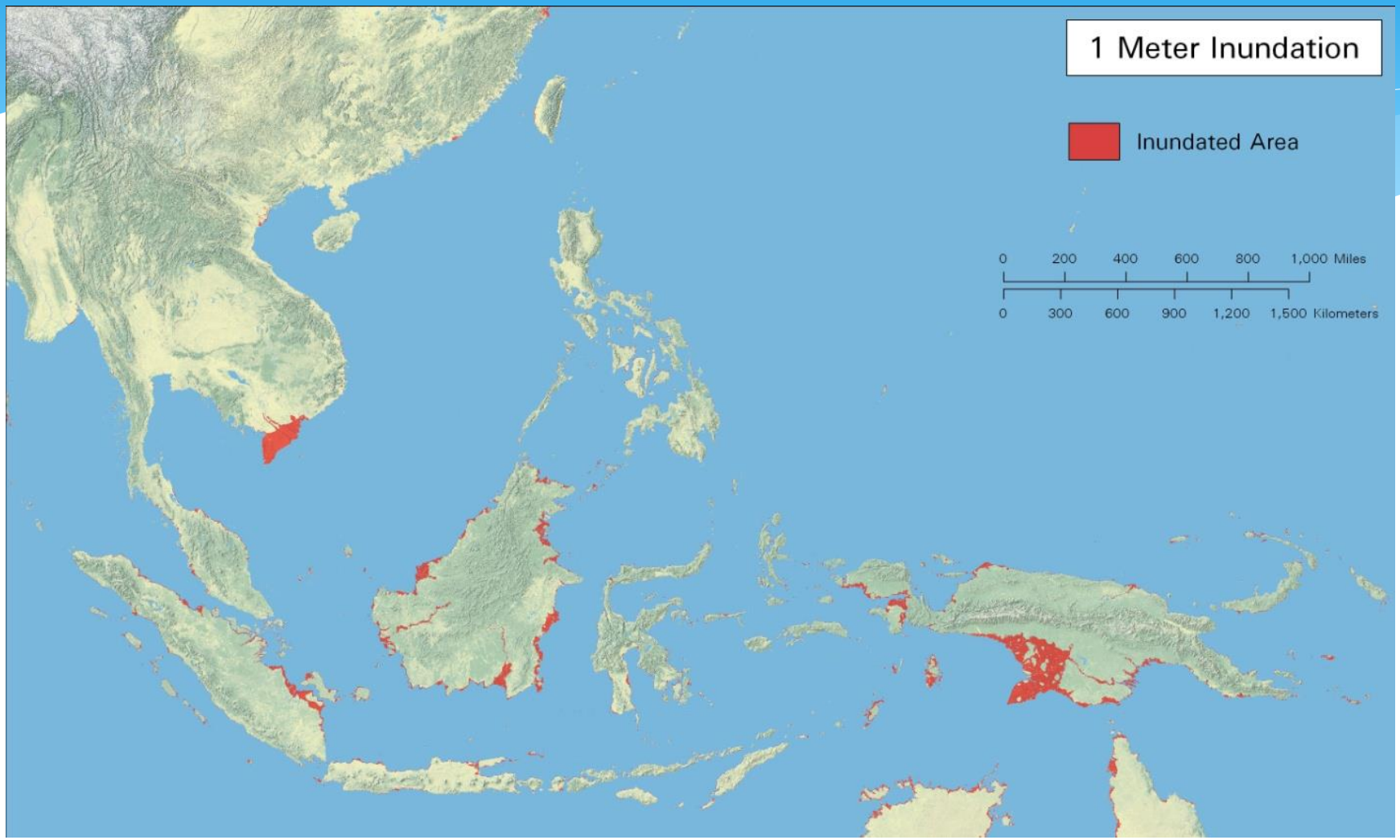
SLR (2)

* **Philippines : Exacerbated by SLR at rate of nearly 1 cm/yr. In addition the frequency and strength of typhoons are projected to increase.**

* **Thailand : SLR in Gulf of Thailand is 3mm/yr, higher than global average; aggravated by subsidence. Exacerbated further by increased intensity of monsoons & storm surges in the Gulf of Thailand.**

* **Vietnam : Rate of SLR is about 3 mm/yr during the 1993–2008 which is comparable with the global rate. The annual high tide level has become higher & higher causing erosion in a number of local areas. More frequent storms.**

SE Asia – 1-metre SLR



(CRESIS)

SE Asia – SLR vulnerability

(Jones et al 2012)

SLR - summary

* Acknowledged by all countries as important factor.

* Most severe in Philippines where SLR is faster than global average rates at rate of nearly 1 cm/yr. Increased intensity of storms.

* Also increased high spring tides causing erosion in Cambodia.

* Low-lying deltas most vulnerable in future. SLR in Gulf of Thailand is 3mm/yr, higher than global average; aggravated by subsidence.

Question 1

* What is the coastal erosion situation in your country?

* What are the major factors responsible for the coastal erosion?

5. Current and planned remediation

Cambodia & Indonesia

* **Cambodia : considering coastal erosion within marine & coastal management. Sihananoukville called for expert to carry research on coastal erosion; Kampot engaged in COBSEA project on coastal spatial planning & coastal erosion.**

* **Indonesia : followed up with Government Regulation No. 64 of 2010 (PP 64, 2010) which details various activities to address coastal erosion. For future coastal erosion management strategy an intervention plan with coastal protection goals is contained in draft Strategic Plan (Planning) Department of Public Works (2010-2014) involving 300 km. For implementation, a Regional Action Plan Document applies to a three-year period for a particular area prepared by process of regional coordination & participation of stakeholders.**

Malaysia and Philippines

* **Malaysia : Overall, DID Guideline 1/97 Guideline on Erosion Control for Development Project in the Coastal Zone (Revision 2012) has been implemented comprehensively by Local Authorities throughout country when approving development projects along shoreline. Integrated Shoreline Management Plan (ISMP) has been completed for some states but no legislative basis for its adoption. Where there is no ISMP the National Physical Plan-Coastal Zone provides an alternative guide for the use of states.**

* **Philippines : revising certain provisions in Comprehensive Land Use Plan, particularly those relating to coastal zone. Making efforts for coastal erosion issue to be addressed at both local & national levels within climate change adaptation & disaster risk reduction management frameworks. Guidebook for coastal erosion management planned.**

Thailand and Vietnam

* **Thailand completed its Coastal Erosion Strategic Plan with a mission that includes prevention of coastal erosion in pristine areas & restoration of affected areas. Plan includes a goal for comprehensive prevention & restoration system to address coastal erosion in every coastal area by 2027.**

* **Vietnam : annual plans for new construction, upgrading & maintenance of dykes & estuaries as well as programmes for restoration & replanting of mangroves to reduce coastal erosion. Local level authorities respond with various measures as dictated by their capacity. Two programmes under its Programme for Disaster Prevention & Mitigation to strengthen, protect & upgrade sea dykes that could be considered as biggest intervention plans addressing coastal erosion to date.**

Sand beach protection starts in Pattaya

Bangkok Post, 16.11.2016; Posted 18.11. 2016 at 12.53

* **Try to establish natural beach stability by imitating one of three major types of beach stability found naturally on : (1) Straight coast (2) Parabolic coast with one headland (3) Crescent coast within two headlands. Several key factors need to be considered, e.g. length of beach, beach orientation to incoming wave energy and direction, grain size of beach sand, occurrence of extreme events. The important point is to minimize the net loss of beach sediments alongshore and to the offshore. The beach should be a self-contained system as much as possible to sustain seasonal and short-term changes – and thus a wide buffer zone is also required. For tourist beaches, grain size in relation to wave energy is an important consideration. Beach nourishment may be used periodically to compensate for the permanent loss of sediments. Avoid hard engineering structures except where they can help to create self-contained beach systems without causing erosion downdrift of the structures.**

48. Re: Coastal Erosion on Cua Dai beach and the resorts, Posted 26.11.2015, 13:14

* …….
* **Basically for a beach, a reasonable belt of coastal vegetation/dunes acts as the assurance for long-term coastal stability. If the protective belt of coastal vegetation/dunes is absent, coastal erosion once initiated during a storm, is likely to continue. To address the coastal erosion over long-term at Hoi An/Danang, an integrated effort, including a buffer zone, replanting of coastal vegetation, re-construction of dunes, ban on sand mining, selective engineered protection measures and beach nourishment should be assessed and implemented.**

Vietnam – Dyke approved for Cua Dai beach to prevent erosion

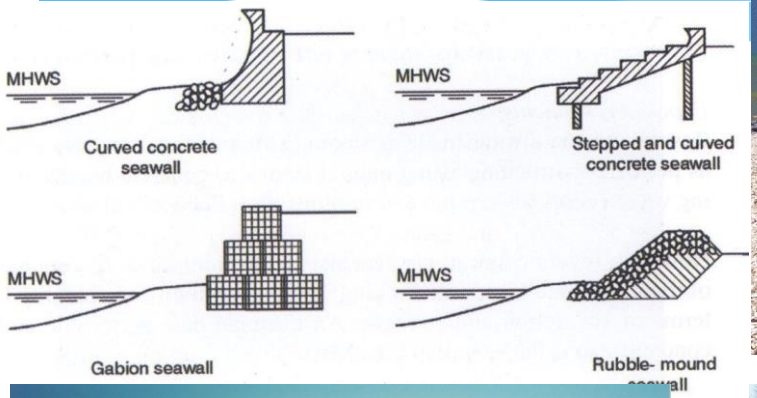
Coastal Engineering News, 10.4.2016, Posted 10.4.2016 at 9:25 am

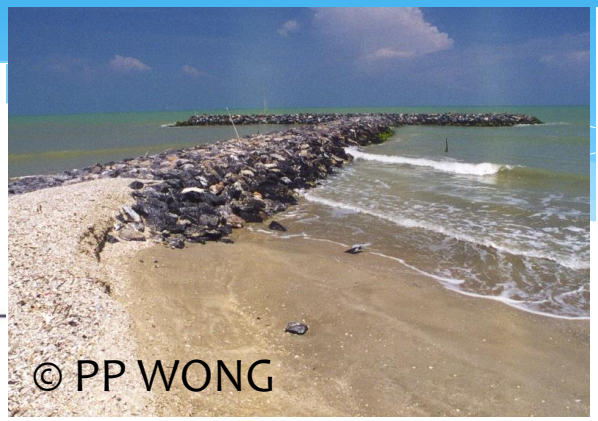
* **Dykes may protect the coast but do not encourage beach formation as shown in dykes/seawalls already constructed along the public park and the coastal road leading to the mouth of Thu Bon River and at several resorts north of the river mouth. The sandy beaches along the Vietnamese coast are protected naturally by high dunes and coastal vegetation. Coastal erosion has resulted as the dunes and coastal vegetation have been removed for the construction of hotels, housing estates and residences. To address the coastal erosion over the long-term on Vietnamese coasts, an integrated effort, including a buffer zone, replanting of coastal vegetation, re-construction of dunes, defined public access paths, ban on sand mining, beach nourishment and selective engineered measures should be assessed and implemented.**

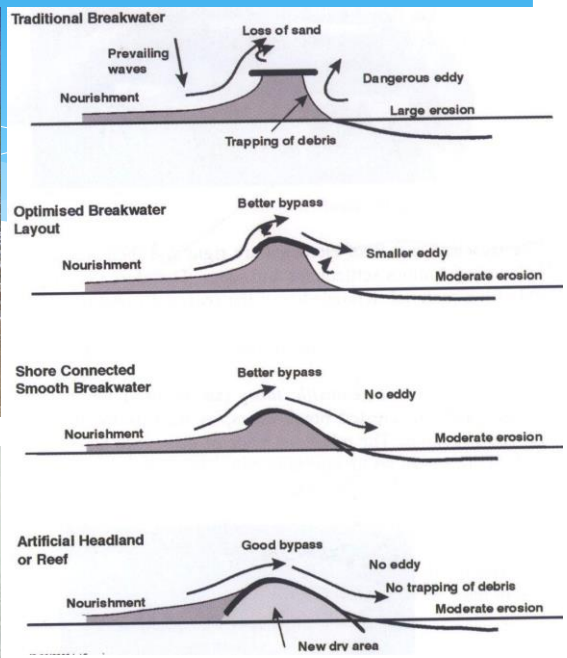
Remediation – hard measures

- **Seawalls, groins, breakwaters.**

(Mangor 2004)

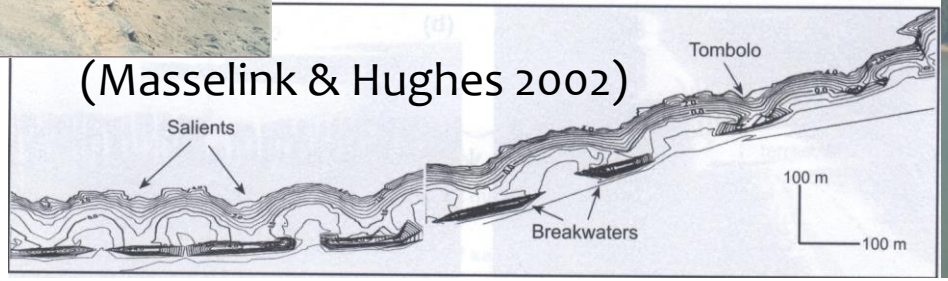






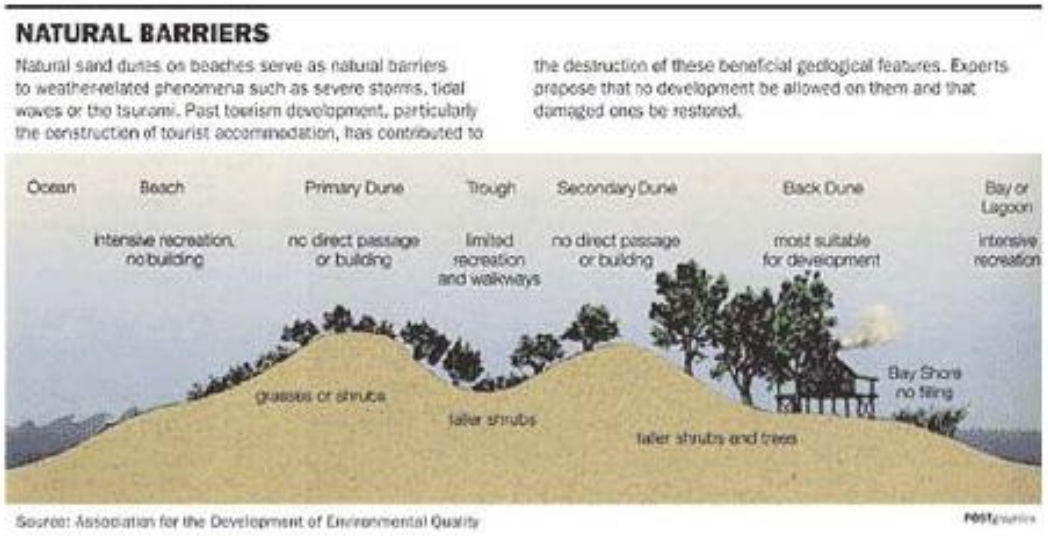
(Mangor 2004)

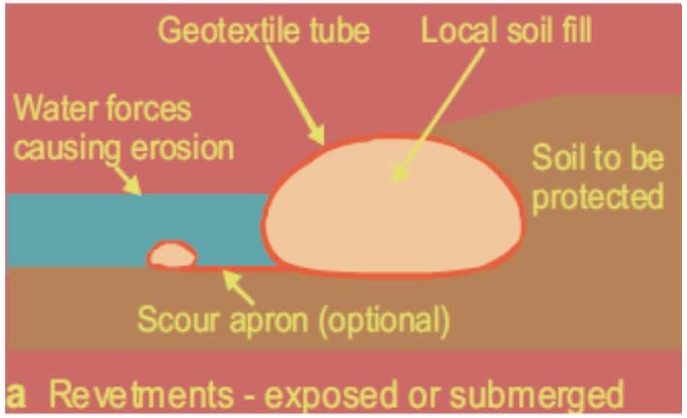
(Masselink & Hughes 2002)



Remediation – soft measures

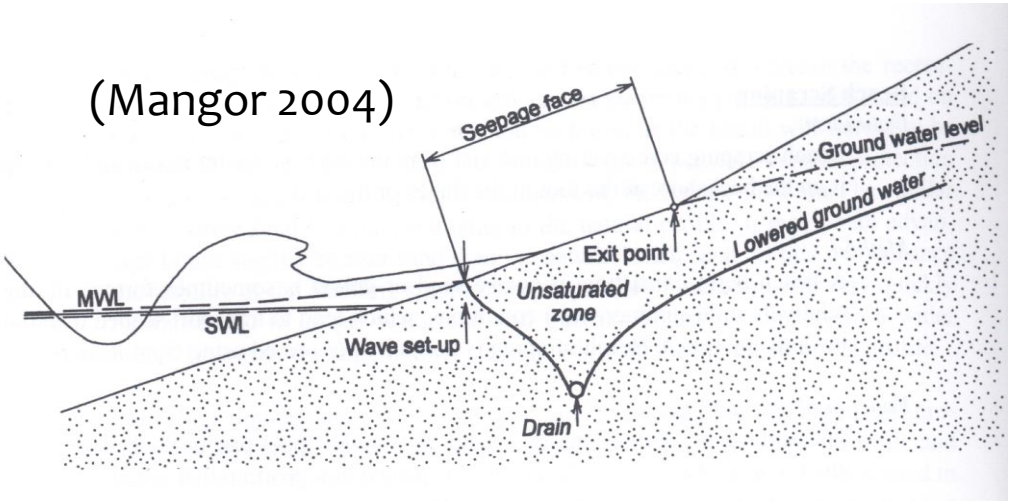
- **Beach nourishment, geotubes, dunes, beach dewatering.**





(Yasuhara et al 2012)

(Mangor 2004)



6. Recommended pilot interventions

Cambodia

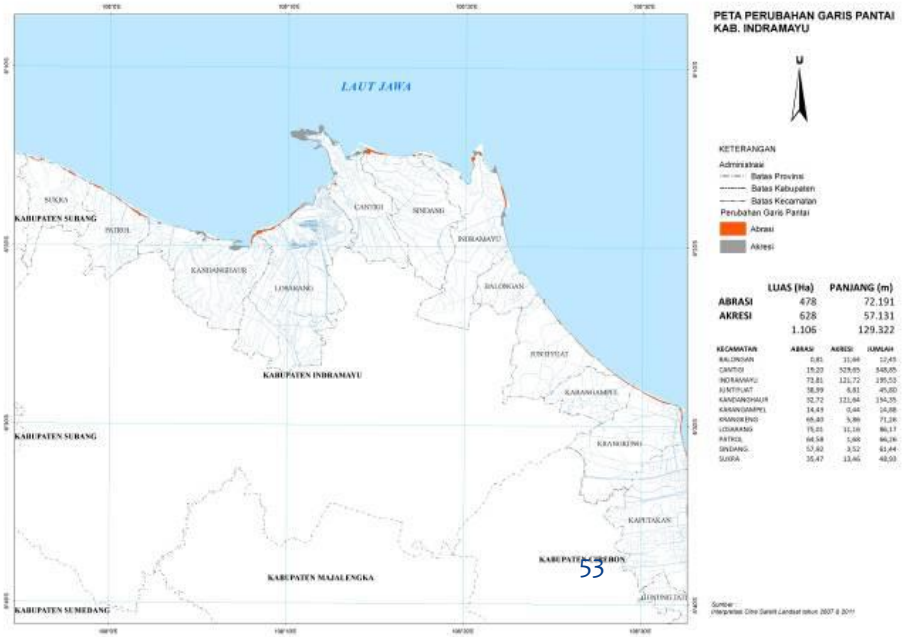
* One pilot location from each of four coastal provinces based on severity, resource sensitivity, degree of impact of erosion to coastal ecosystem, environmental, social & economic impact of coastal erosion, coping capacity for coastal erosion & economic value of land or structures.

* Recommended a pilot intervention at Prek Thnot village, Kampot province : include set up of institutional arrangement, development of a strategy & plan on coastal erosion management, two workshop & two awareness campaigns on coastal erosion management, promotion of alternative livelihoods & mangrove restoration & management.

Indonesia

* **Procedure in prioritization of eroded beaches: a review of regional overview, subsequent beach erosion risk assessment impact & then proposed beach erosion treatment options.**

* **Proposed Indramayu District on north coast of West Java Province where beach erosion requires both physical & non-physical intervention activities.**

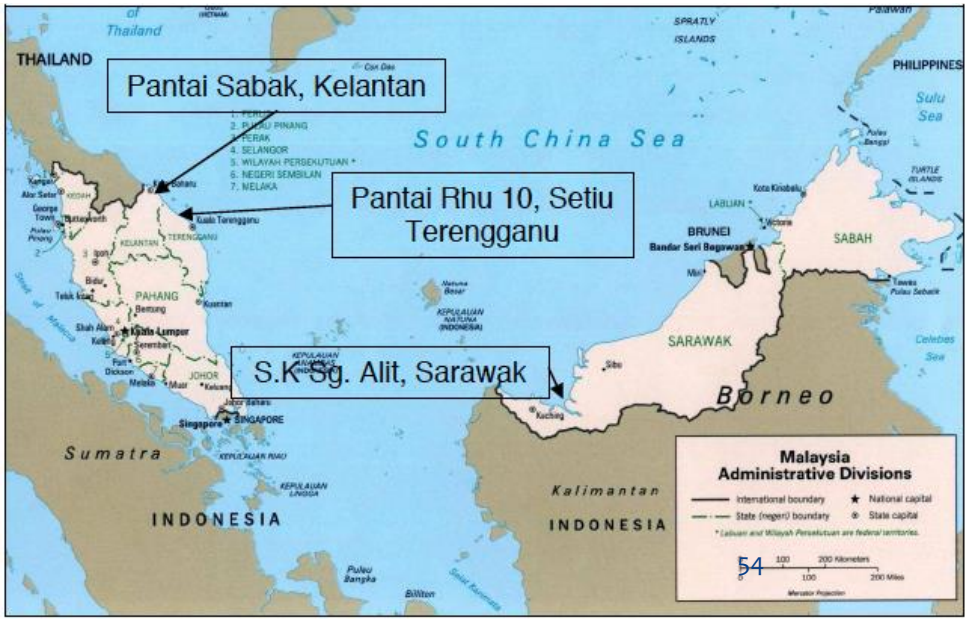


(Indonesia NAR)

Malaysia

* Malaysia **proposed three sites** with critical erosion for pilot intervention.

* **Selected Pantai Rhu, Setiu, Terengganu** on basis : erosion has affected public & private properties; more public properties than other two sites; potential for eco-tourism & an environmental sensitive area (turtle hatching); enhance knowledge of relevant agencies on coastal erosion problems.



(Malaysia NAR)

Philippines

* **Selected four sites for pilot interventions : erosion threatens a large community or are ecologically critical.**

* **Recommended two sites :**

(1) Batangas City (including Verde Island) : large-scale development obstructing sediment drift; ecological critical region; high vulnerability to climate change. Actions to include mangrove restoration, review options for hard engineering.

(2) Boracay : tourism areas with prevalent coastal erosion. Actions to include polluted water control, beach nourishment, removal of structures impeding littoral transport, regulation of tourism activities & EIA for construction of protection measures.

Thailand

* Focus on Samut Songkhram province with mangrove forests along its coast.

* Recommended interventions include :

(1) Preparation of Master Plan for coastal erosion prevention & mitigation;

(2) Training on coastal zone management;

(3) Training on coastal erosion assessment, prevention & mitigation; &

(4) Publication of key publications on climate change & sea level rise tailored for the Thai audience.

Vietnam

* Selected national key areas of coastal erosion.

* Recommended Thanh Hoa province to include : evaluation of coastal erosion resolution; investigation of the actual coastal erosion status & causes; development of coastal vulnerability maps; organization of conferences to disseminate knowledge regarding disaster prevention, coastal ecosystems protection & sustainable development; support for new planting mangroves & casuarina forest ; support for repair/construction of one kilometer of damaged dykes by using environmental friendly technology; & proposed resolution strategies.

* Valuable lessons in addressing coastal erosion in other coastal provinces, as well as provide scientific basis for creation of a national strategy for coastal erosion management in Vietnam.

Vietnam – pilot intervention site

(Vietnam NAR)

Summary of pilot interventions

Summary

* **Pilot interventions should preferably fall under three categories :**

* **1) Policy support, like developing a strategy on coastal erosion or creation of a national coastal erosion coordination committee.**

* **2) Knowledge & capacity support, like database on coastal erosion, sensitivity mapping or training & capacity building.**

* **3) Direct support to build community or ecosystems resilience (e.g. mangrove planting/restoration) or 'on the ground' application.**

Direct support

* **Cambodia : promotion of alternative livelihoods & mangrove restoration & management.**
* **Indonesia : mainly physical interventions : mangrove rehabilitation, maintenance & construction of structures.**
* **Malaysia : beach nourishment & related works.**
* **Philippines : mangrove restoration, beach nourishment.**
* **Vietnam : mangrove planting, repair/construction using soft measures.**
* **Summary : strong emphasis on mangrove planting & rehabilitation.**

7. Good practices

Meaning

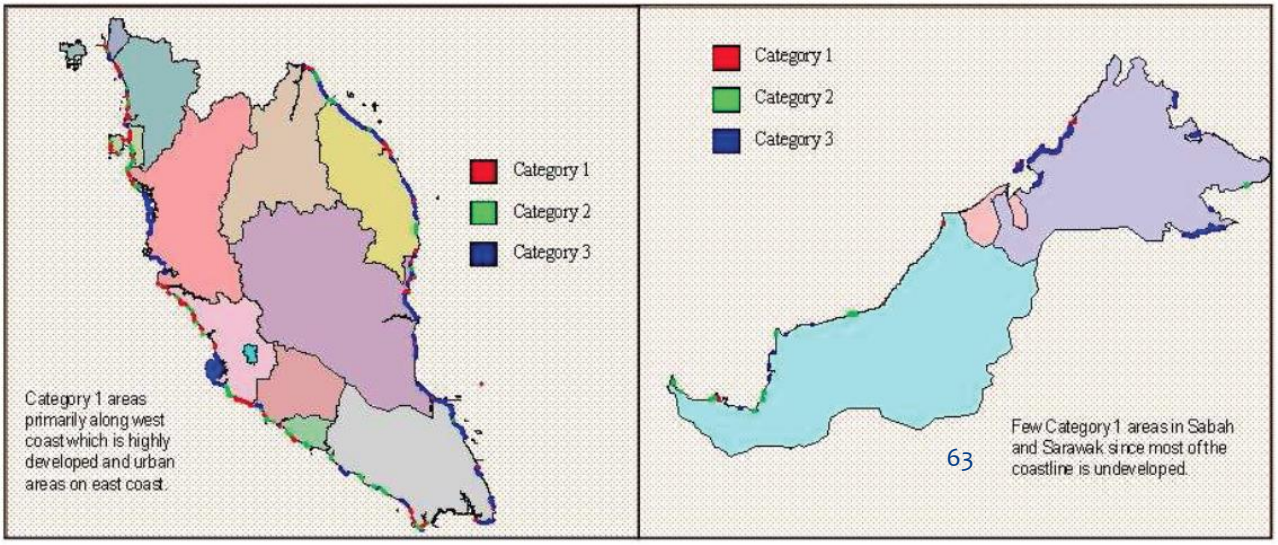
* **Difference & confusion on usage.**
* **Best practice, e.g. wearing seat belt in cars, wearing safety helmets.**
* **Over time when it becomes a habit or used commonly, it is good practice.**

Coastal erosion survey

* **Malaysia : National Coastal Erosion Study in 1986. Updated in 2006 by Dept of Irrigation & Drainage.**

* **Thailand : most recently completed survey by Dept of Environment & Natural Resources (DENR) : down to sub-district level.**

(Thailand NAR)



(Malaysia NAR)

Identification of hotspots

* **Different methods.**

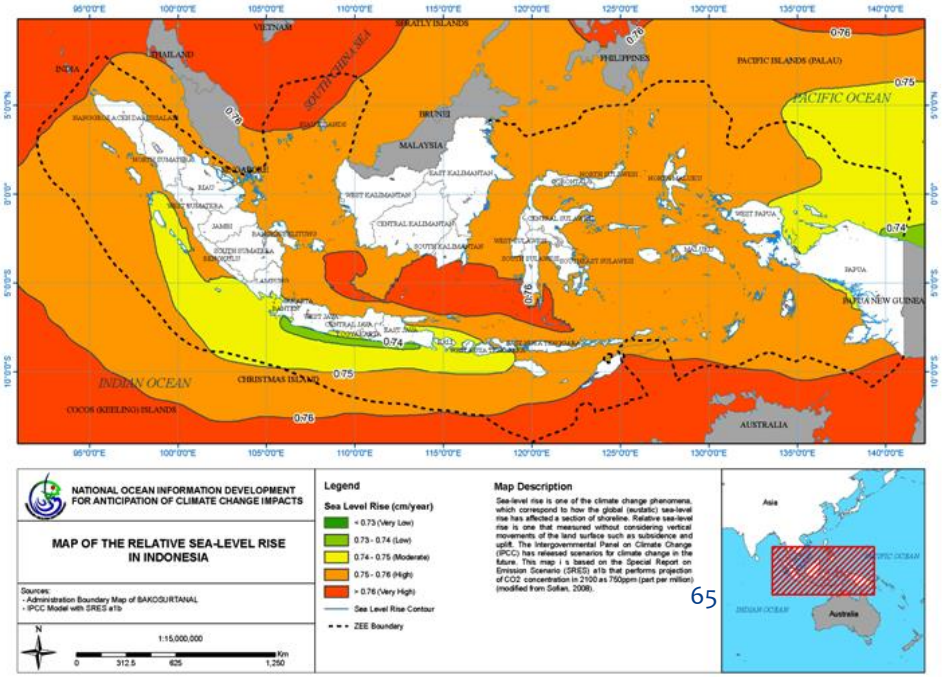
* **National surveys : different criteria used. Malaysia : critical areas : where shore-based facilities are in imminent danger of loss or damage. Thailand : high-risk areas (erosion >5 m/yr). Indonesia : coastal vulnerability index (very high).**

* **Philippines : hotspots from available 10% survey.**

Monitoring of SLR

* **Recognized importance of SLR.**

* **Monitoring of sea level as good practice. Philippines : average sea-level rise of 7 to 8 mm/yr in past two decades certainly contributes to prevalence of erosion in country. Excessive groundwater withdrawal, conversion of mangrove areas to fishponds & other natural factors, which can be larger than that due to global warming, compounds problem.**



(Indonesia NAR)

Implementing CZM

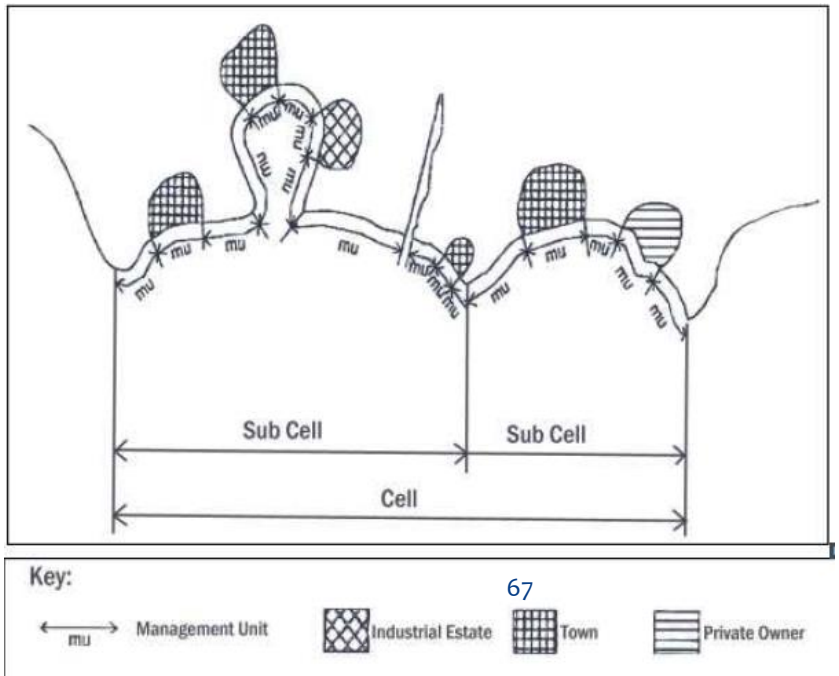
* **Cambodia : Coastal provinces of Kampot, Kep & Koh Kong have indicated interest to be part of integrated coastal management scaling-up programme. Kampot engaged in COBSEA-supported project on coastal spatial planning & coastal erosion.**

* **Indonesia : Implementing integrated coastal management under Law 27 Year 2007 on the Management of Coastal Areas & Small Islands to guide responses to coastal erosion events & long-term integrated management of coastal areas. This law is clear about values & functions of the coast, including ensuring public safety or maintaining ecological integrity of coastal system.**

Shoreline management plan

* **Malaysia : Integrated Shoreline Management Plans (ISMP) is based on Management Unit approach with the input from the various stakeholders; available for Malacca, Penang, Negri Sembilan & Pahang.**

* **NPP-CZ (National Physical Plan – Coastal Zone) provided as a guide for use of states as an alternative when there is no ISMP.**



(Malaysia NAR)

Mainstreaming into DRR

* **Vietnam : measures against coastal erosion are still only included under common provisions in Natural Disasters Management Programme; annual plans for new construction, upgrading & maintenance of dykes & estuaries as well as programmes for restoration & replanting of mangroves.**

* **Philippines : Local government units are presently enhancing their respective Comprehensive Land Use Plans (CLUP) & zoning ordinances to jointly consider CCA (climate change adaptation) & DRRM (disaster risk reduction management), staging a crucial opportunity to advocate recommendations relating to coastal erosion such as review & adjustment of current easement & setback standards.**

Mainstreaming into CCA

* **Philippines : recent policies & plans relating to climate change adaptation (CCA) & disaster risk reduction & management (DRRM) present potential entry points for actions to address coastal erosion.**

* **More recent policy the Climate Change Act of 2009 (RA 9729) provides potential opportunities for development, introduction & advocacy of actions to address coastal erosion, in relation to dealing with climate-related impacts.**

* **With increasing magnitude of typhoons, attention to measures to protect coasts.**

Coastal erosion manual

* **Philippines : Guidebook for coastal erosion management in early stages of development by University of Philippines Marine Science Institute.**

* **Will contain site-specific strategies for coastal erosion prevention & mitigation, drawn from field experiments, local examples, as well as from other countries.**

* **Will provide options for coastal protection as it explores effectiveness of both hard & soft engineering measures to come up with menu of best available practices for addressing coastal erosion.**

Hard and soft measures (1)

* **Vietnam : exposed to open ocean with typhoons & storm surges. Special case – dykes & seawalls.**

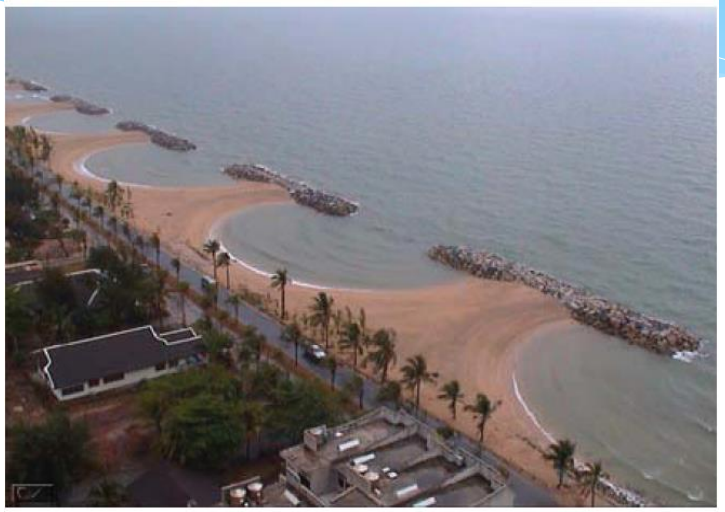
* **Experience in use of 'sand sausages'.**

(Vietnam NAR)

Hard and soft measures (2)

* **Thailand : combination of hard & soft measures.**
* **Major problem in dealing with muddy coasts.**

(THAILAND NAR)



Ecosystem-based adaptation (EBA)

* **Emerging approach using biodiversity & ecosystem services (supporting, provisioning, regulating, cultural) as part of overall strategy to adapt to adverse effects of climate change.**

* **Part of broader portfolio of adaptation measures – can be applied at different geographical scales & within various time frames.**

* **Is cost-effective to protect communities from climate change & extreme weather events.**

* **More attention to mangroves : underestimated & not fully understood.**

Question 2

* **What innovative or unusual approaches or measures have your country taken to address coastal erosion?**

8. Conclusion

Proposed regional project

Future/proposed for UNEP

* **Builds on previous three COBSEA projects (Sida, KOICA/Yeosu, MFF) & priority interventions.**

* **Deploys a new Coastal Erosion Document (CED) which integrates previous knowledge, approaches & lessons from projects & includes additional knowledge to address present & future coastal erosion.**

* **Uses Key Demonstration Sites (KDS), some available from existing pilot interventions & others listed by countries.**

* **Involves 6 Training-the-Trainers (TOT) workshops, each training 150 participants from 6 countries, training total of 900 trainers. Given 158,000 km in 6 countries, training would give a ratio of 1 trainer to 175 km of coastline, which is more than 3.5 times better than the ratio of 1 trainer to 630 km in the Sida project.**

* **Estimated budget USD2 million over 3 years.**

Thank you

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