





Assessment of Coastal Vulnerability to Sea Level Rise in Southeast Asia: Some Management Considerations

Beverly Goh
NSSE, National Institute of Education, NTU

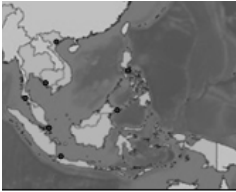


"INTEGRATED VULNERABILITY ASSESSMENT OF COASTAL AREAS IN THE SOUTHEAST ASIA AND EAST ASIAN REGION"



INTERNATIONAL SECRETARIAT

Coastal Vulnerability Assessment



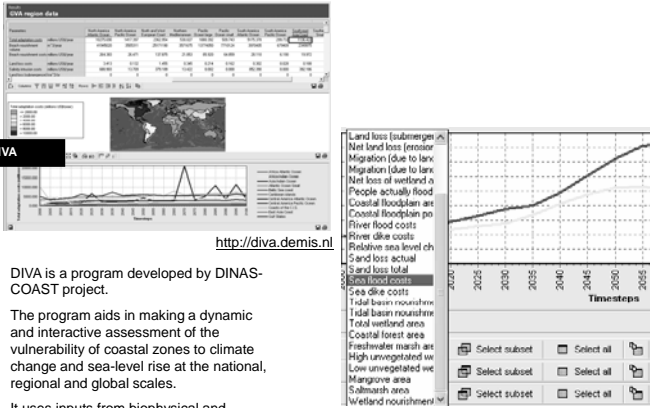
June 2005
LOICZ 16th SSC and Inaugural OSM

DIVA

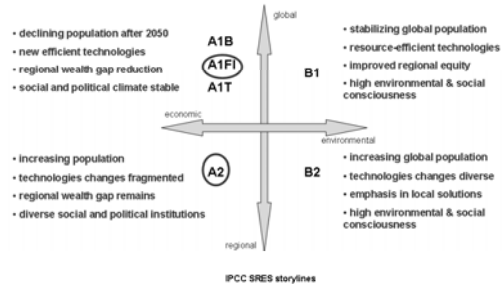
DIVA is a program developed by DINAS-COAST project.

The program aids in making a dynamic and interactive assessment of the vulnerability of coastal zones to climate change and sea-level rise at the national, regional and global scales.

It uses inputs from biophysical and socioeconomic data, which can be defined/specified by the user to create various scenarios.



<http://diva.demis.nl>



IPCC SRES storylines

The IPCC Special Report on Emission Scenarios Storylines(4th IPCC Report). Highlighted in red - scenarios with the highest predicted carbon production from fossil combustion.

High Loss of Doing Nothing!

e.g. Migration due to land loss

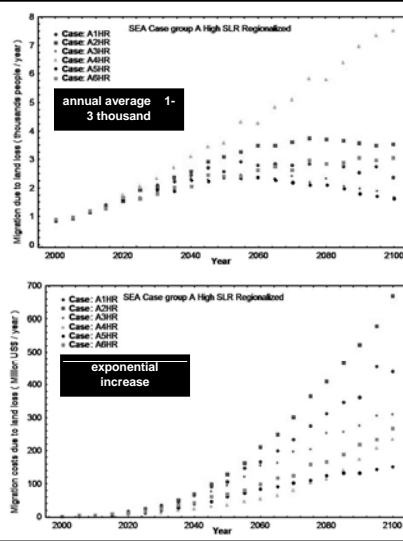
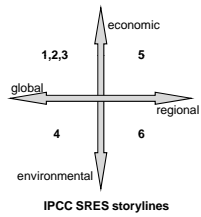
A1HR

type of mitigation-NO NOURISHMENT

NO. 1 of the IPCC SRES storylines

HIGH Sea Level Rise

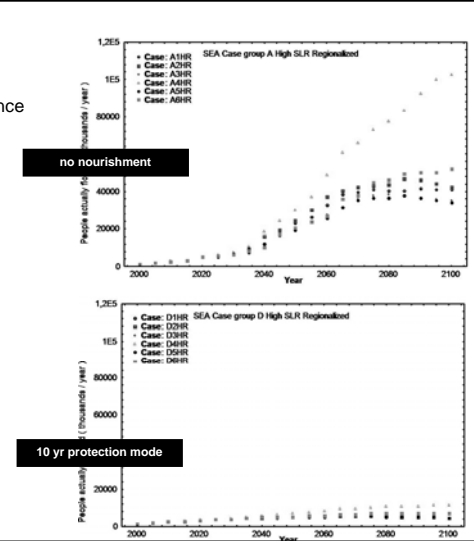
REGIONALIZED analysis



“Sea Walls/Dikes” are good options

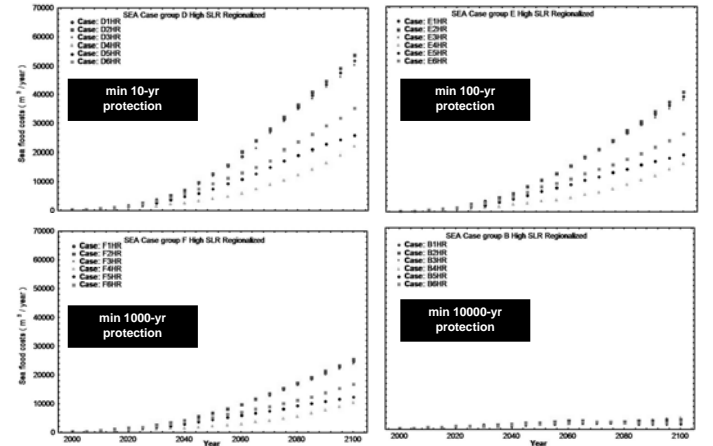
- people actually flooded
- land loss due to submergence
- sea flood costs

e.g. people actually flooded



Effectiveness of “Sea Walls/Dikes” depends on administrative unit level

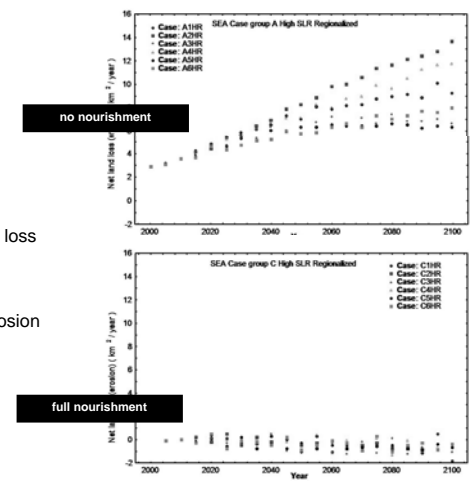
e.g. sea flood costs



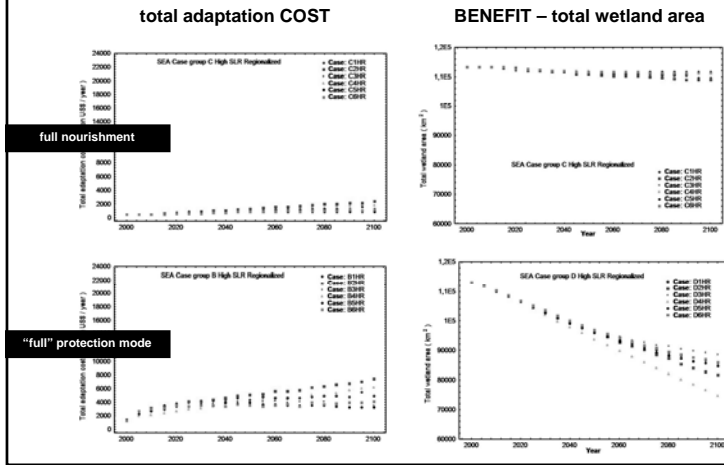
In SEAsia Full Beach Nourishment is better

- preservation of
 - wetland area
 - coastal forest
 - mangrove
- minimize
 - net land loss due to erosion
 - sand loss total
 - migration due to land loss

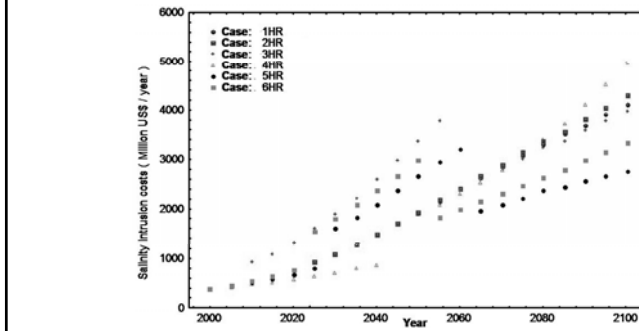
e.g. net land loss due to erosion



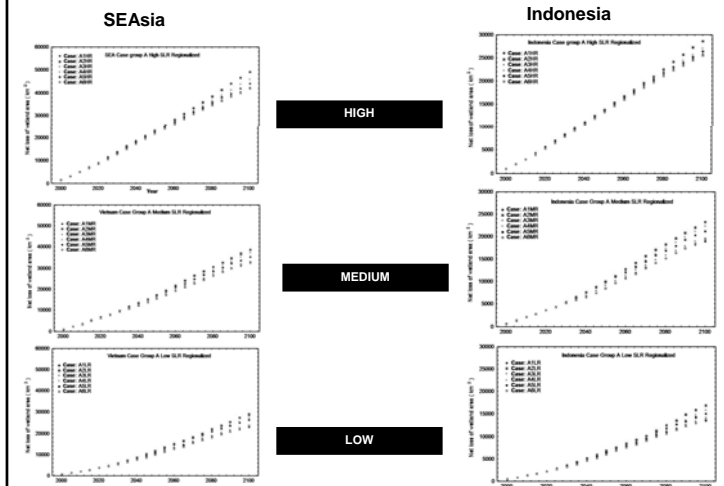
Full Beach Nourishment option also wins in cost and benefit analysis



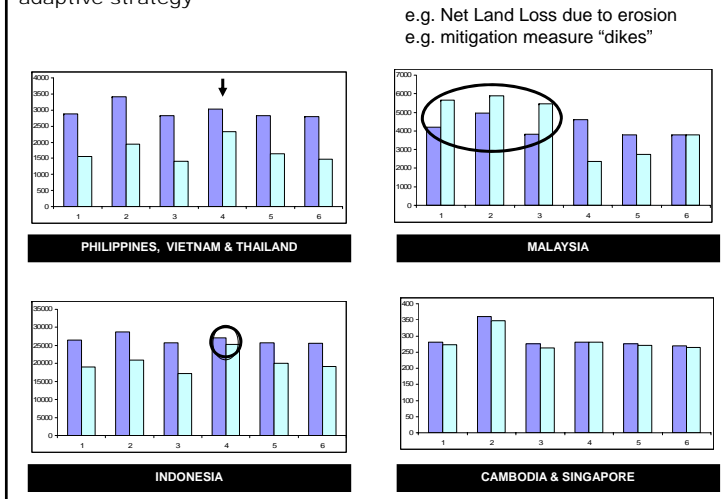
No effective mitigating measures for salinity intrusion

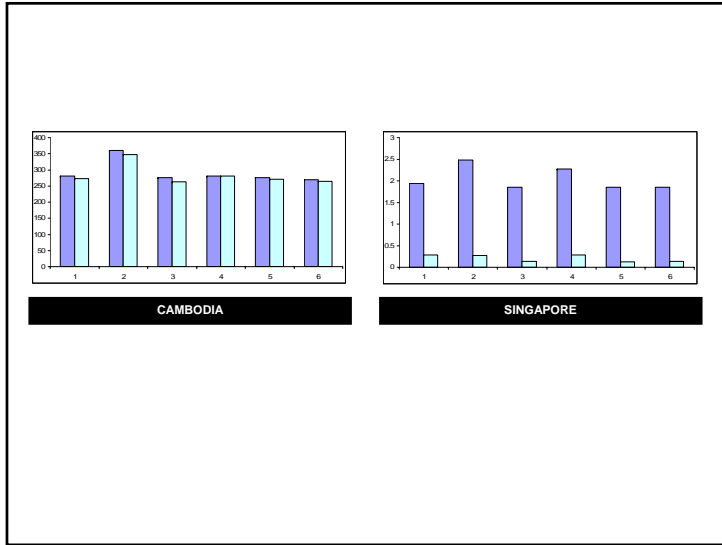


Sea Level Rise affect magnitude of loss and costs



Country-specific response to adaptive strategy





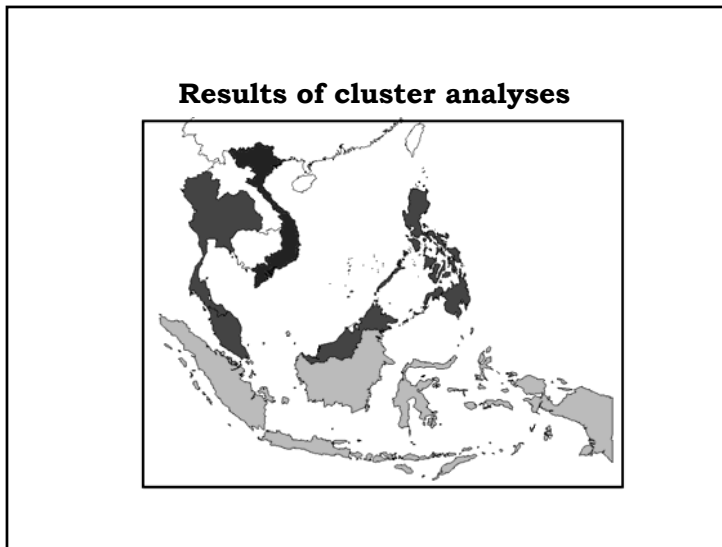
Welcome to DISCO

DISCO

<http://fangorn.colby.edu/disco-devel/main.php>

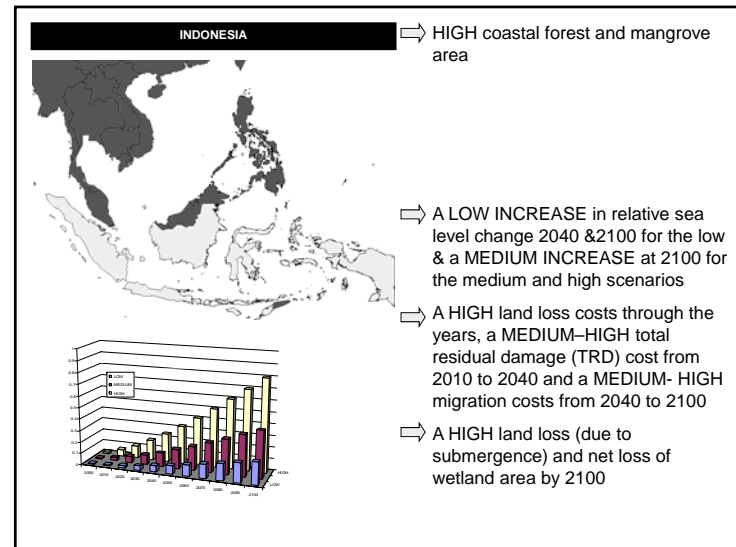
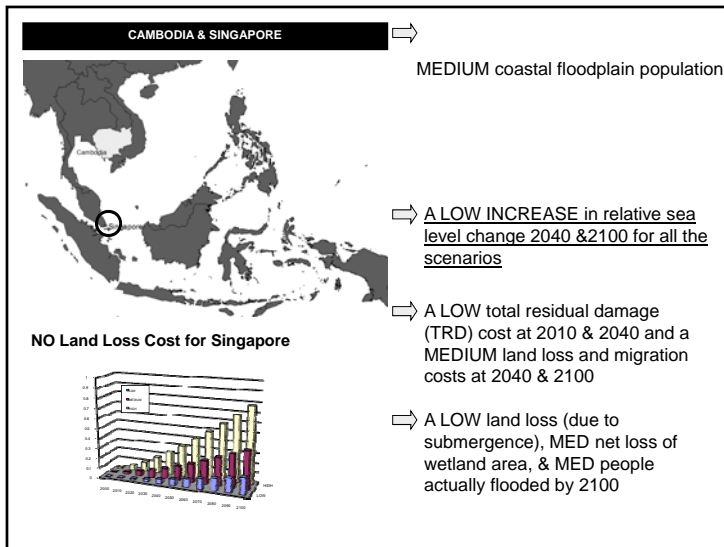
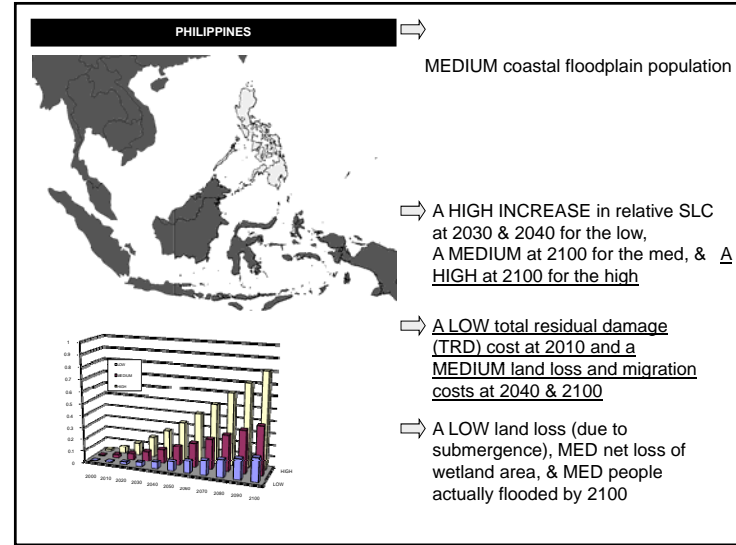
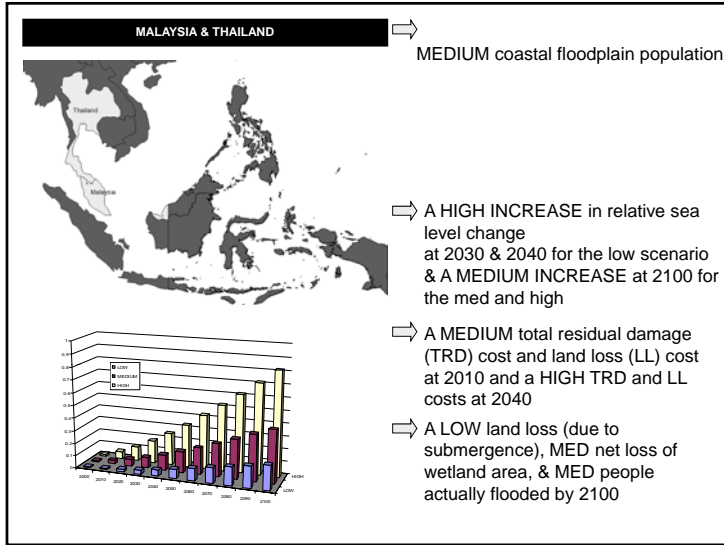
DISCO is an on-line data analysis tool for performing cluster analysis and related operations. Cluster analysis is an important tool for discovering structure in complex data sets.

- existing situation
 - Coastal floodplain population
 - Coastal forest area
 - Mangrove area
 - Saltmarsh area
- relative sea level rise
 - 2010
 - 2040
 - 2100
- cost of doing nothing
 - Total residual damage costs
 - Land loss costs
 - Migration (due to land loss) costs
- effect on coast by 2100
 - Land loss (submergence)
 - Net loss of wetland area
 - People actually flooded

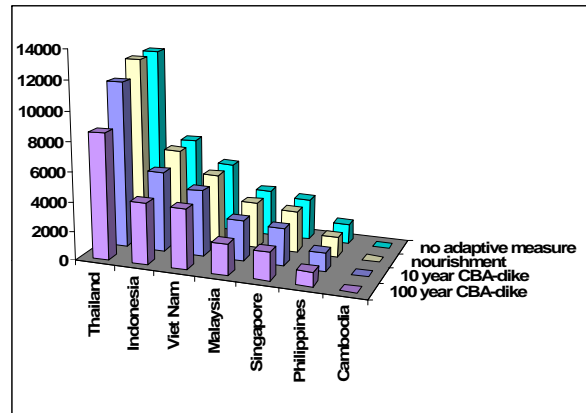


VIETNAM ⇒ HIGH coastal floodplain population

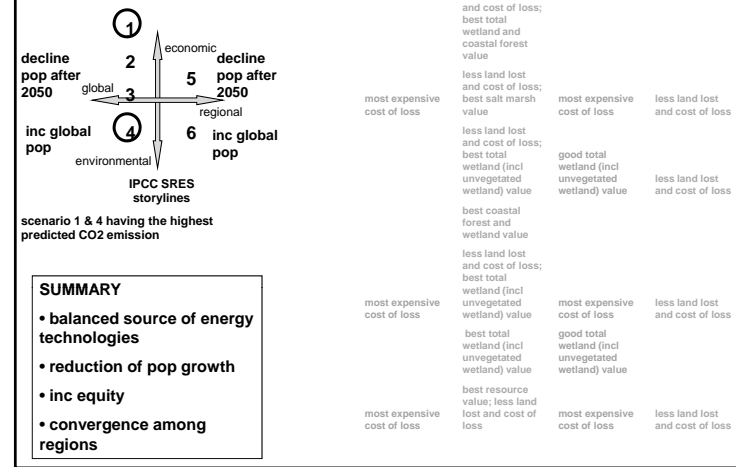
- ⇒ A HIGH INCREASE in relative sea level change at 2040 for the low SLR scenario & at 2100 for the med and high
- ⇒ A HIGH total residual damage cost at 2010 & 2040 and a MEDIUM migration (due to land lost) at 2040 & 2100
- ⇒ A HIGH land loss (due to submergence), HIGH net loss of wetland area, & HIGH people actually flooded by 2100



Total residual damage cost prediction for the year 2100 using a high sea level rise scenario



CO2 concentration and population affect adaptive strategy effectiveness




Summary of results

- Adaptation to impacts of sea level rise requires engineering measures to limit damage to human populations and coastal resources;
- Country-specific and target-specific application of cost-benefit relation between beach nourishment and sea walls / dikes;
- Extent of impact dependent on underlying IPCC SRES storyline;
- Global effort should be exerted towards a target of B1 or A1T scenarios

Use of Conceptual Diagrams:

Identification of vulnerable coastal areas on a smaller refined scale in individual countries for targeted case studies

Proposed case studies for coastal vulnerability in SE Asia to sea level rise



VIETNAM (Red River Delta)

- Storm frequency
- Aquaculture expansion
- Land reclamation

PHILIPPINES (Batangas Bay)

- Salt water intrusion
- Storm surge
- Urbanization

CAMBODIA

- Storm frequency
- Coastal inundation
- Land subsidence

MALAYSIA (Darvel Bay)

- Salt water intrusion
- Sedimentation

SINGAPORE

- Flooding
- Erosion

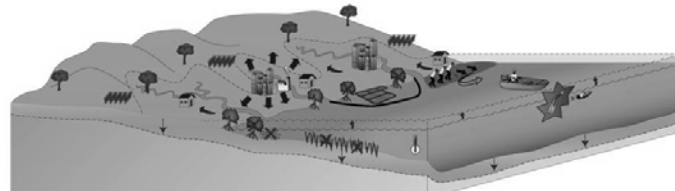
INDONESIA (Jakarta Bay)

- Flooding

THAILAND (Andaman coast)

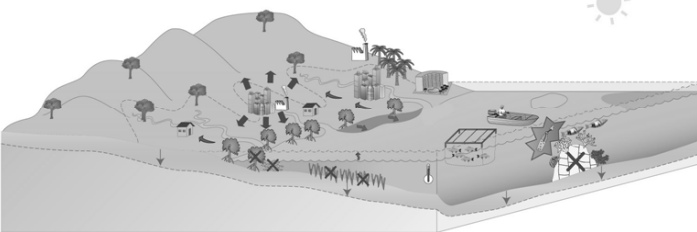
- Saltwater intrusion
- Flooding
- Pollution
- Land cover change

Red River Delta, Vietnam



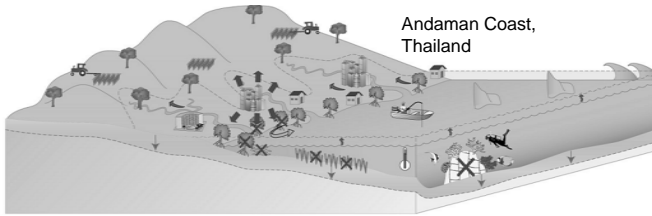
- Coastal communities
- Agriculture
- Sea level rise
- Land subsidence
- Coastal inundation
- Sea dyke construction
- Loss of coastal ecosystems (mangroves, seagrass)
- Loss of nursery habitat
- Increasing urbanization & industrialization
- Erosion balanced by sedimentation & accretion
- Increasing water temperature
- Aquaculture ponds
- Destructive fishing practices
- Shellfish collectors

Darvel Bay, Sabah, Malaysia

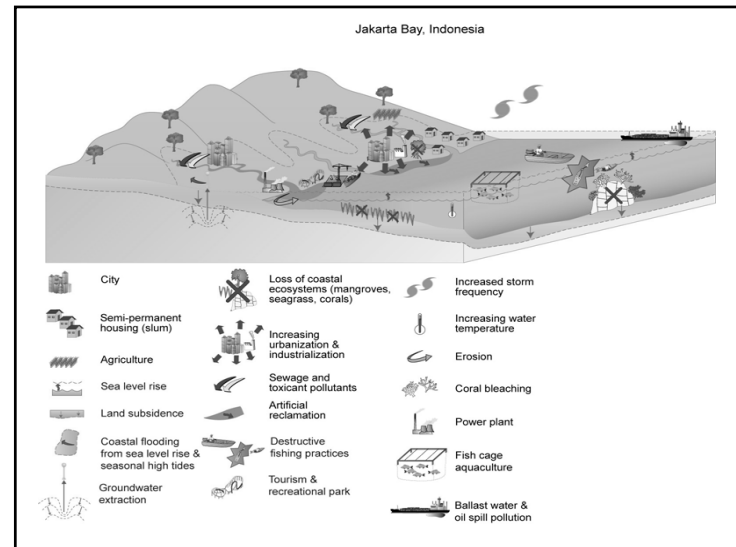
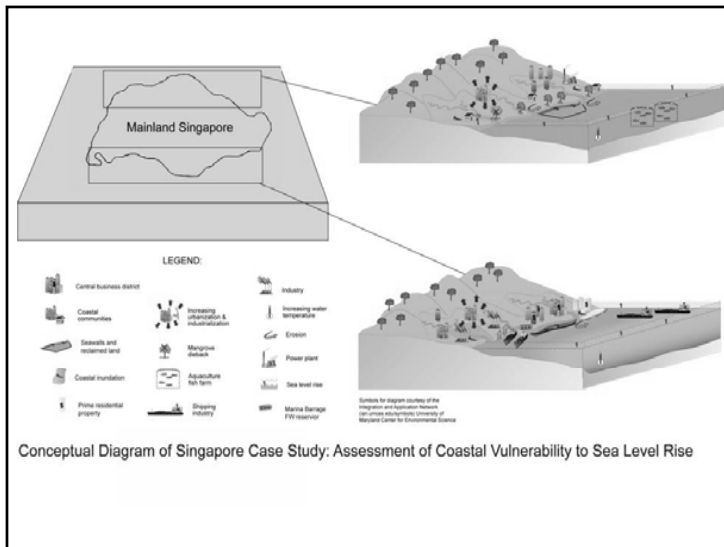
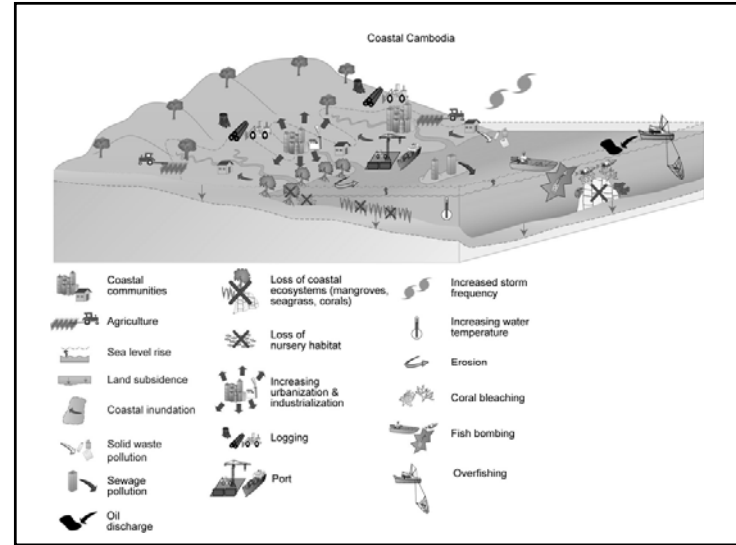
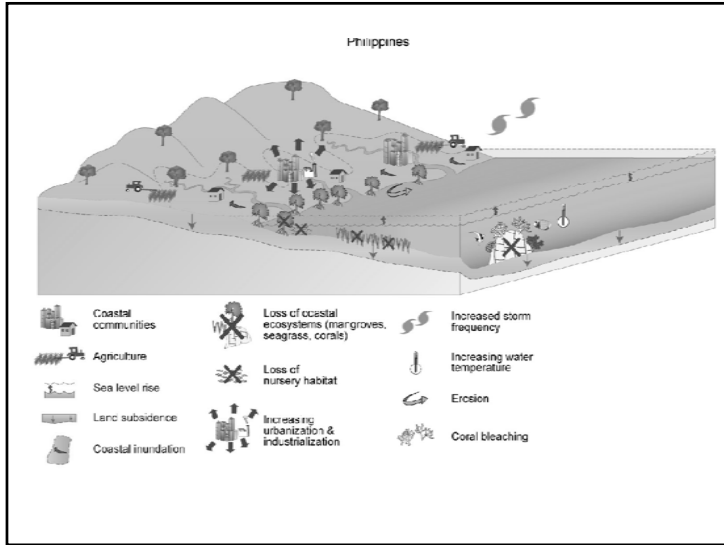


- Coastal communities
- Agriculture
- Sea level rise
- Land subsidence
- Coastal inundation
- Loss of coastal ecosystems (mangroves, seagrass, corals)
- Loss of nursery habitat
- Increasing urbanization & industrialization
- Sedimentation & accretion
- Increasing water temperature
- Palm oil production and refinery
- Coral bleaching
- Algae blooms
- Aquaculture
- Resorts
- Fish bombing

Andaman Coast, Thailand



- Coastal communities
- Agriculture
- Sea level rise
- Land subsidence
- Coastal inundation
- Tsunami
- Loss of coastal ecosystems (mangroves, seagrass, corals)
- Loss of nursery habitat
- Increasing development
- Tourism
- Resorts
- Increasing water temperature
- Erosion
- Coral bleaching
- Sustenance fishing



Management and Policy Considerations

- Management and policy decisions can be enhanced with the proper scientific inputs;
- In this project, a modeling tool has been used to give a preliminary regional perspective, with several options for adaptation to sea level rise;
- On a more refined scale, conceptual diagrams are useful for identifying specific issues and highlight sensitive areas for further study;
- The final phase of this regional project will focus on policy ad cost-benefit analysis specifically relevant to the management and governance of coastal areas at risk to global environmental change.

TEAM:
 Beverly Goh, Ph.D. National Institute of Education, Nanyang Technol. U., Singapore, beverly.goh@nie.edu.sg
 Laura T David, Ph. D. U. Philippines Marine Science Institute, Philippines, ldavid@upmsi.ph
 Rommel Maneja, U. Philippines Marine Science Institute, Philippines, rmaneja@yahoo.com
 Felino Lansigan, Ph.D. U. Philippines Los Banos, Philippines, fl@instat.uplb.edu.ph
 Pich Sereywath, Department of Fisheries, Cambodia, sereywath_pich@yahoo.com
 Ivonne M. Radjawane, Ph.D., Bandung Inst. of Tech., Indonesia, ivonne@geoph.itb.ac.id
 Bernardette M. Manjaji Matsumoto, Ph.D., U. Malaysia Sabah, Malaysia, mabel@ums.edu.my
 Ejria Saleh, Ph.D., Ph.D., U. Malaysia Sabah, Malaysia
 Ben S. Malayang III, Silliman University, Philippines, benliim@yahoo.com
 Pitiwong Tantichodok, Ph.D., Walailak University, Thailand, tpitiwon@wu.ac.th
 Anond Snidvong, Ph.D., Chulalongkorn University, Thailand, anond@start.or.th
 Nguyen Hoang Tri, Ph.D. Center for Environmental Res & Education, Vietnam, CERE@hvn.vnn.vn
 Kim Anh Thi Nguyen, Ph.D. Nha Trang University of Fisheries, Vietnam, sonanhcc@yahoo.com
 Yoshiki Saito, Ph.D., Geological Survey of Japan, Japan, yoshiki.saito@aist.go.jp
 Jochen Hinkel, Ph.D. Potsdam Institute for Climate Impact Research, Germany, hinkel@pik-potsdam.de

SEA-START Regional Centre, Thailand
 LOICZ-IPO, Germany;
 LOICZ-SEAsia Regional Node, Singapore

