

Vulnerability and adaptation of coastal cities in Southeast Asia

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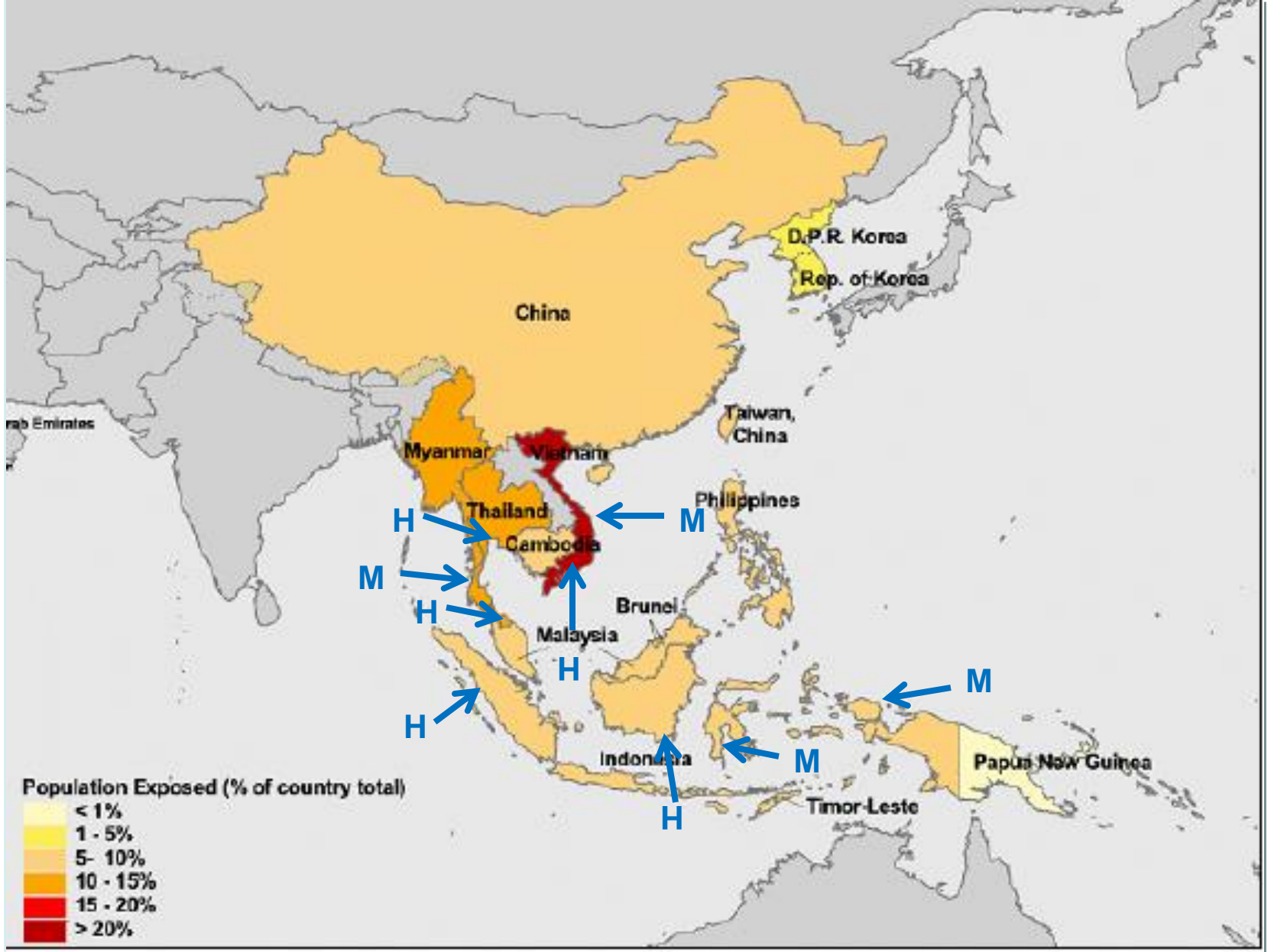


Outline

1. Introduction and overview
 - Climate change issues in SEA
 - About our project
 - Conceptual framework and methodology
2. Results of the 15-city study
 - Hazards
 - Vulnerable sectors/groups
 - Adaptation actions
3. Detailed study of selected cities and piloting actions
 - Results of on-going assessment
 - Proposed piloting adaptation actions
4. Barriers and opportunities

What Makes SEA Vulnerable to Climate Change?

- Vulnerabilities **intrinsic to the region's geographical locational, and socio-economic characteristics**
- **Home to rapidly growing coastal and deltaic mega-urban regions** (Bangkok, Jakarta, Manila and Ho Chi Minh),
 - Coastal cities already faced existing environmental hazards and changes and exacerbated by CC
- **Consequences of CC impacts are interrelated** and often tied with the urban economy, livelihoods, and natural disasters
- **Heavy reliance on climate-sensitive sectors** for food and livelihood on fisheries, agriculture, forestry and tourism,
 - its high concentration of coastal urban population and economic activity
- **Lack of comprehensive knowledge and information** that could serve for planning and implementing adaptation measures needed hampers adaptation practitioners in SEA



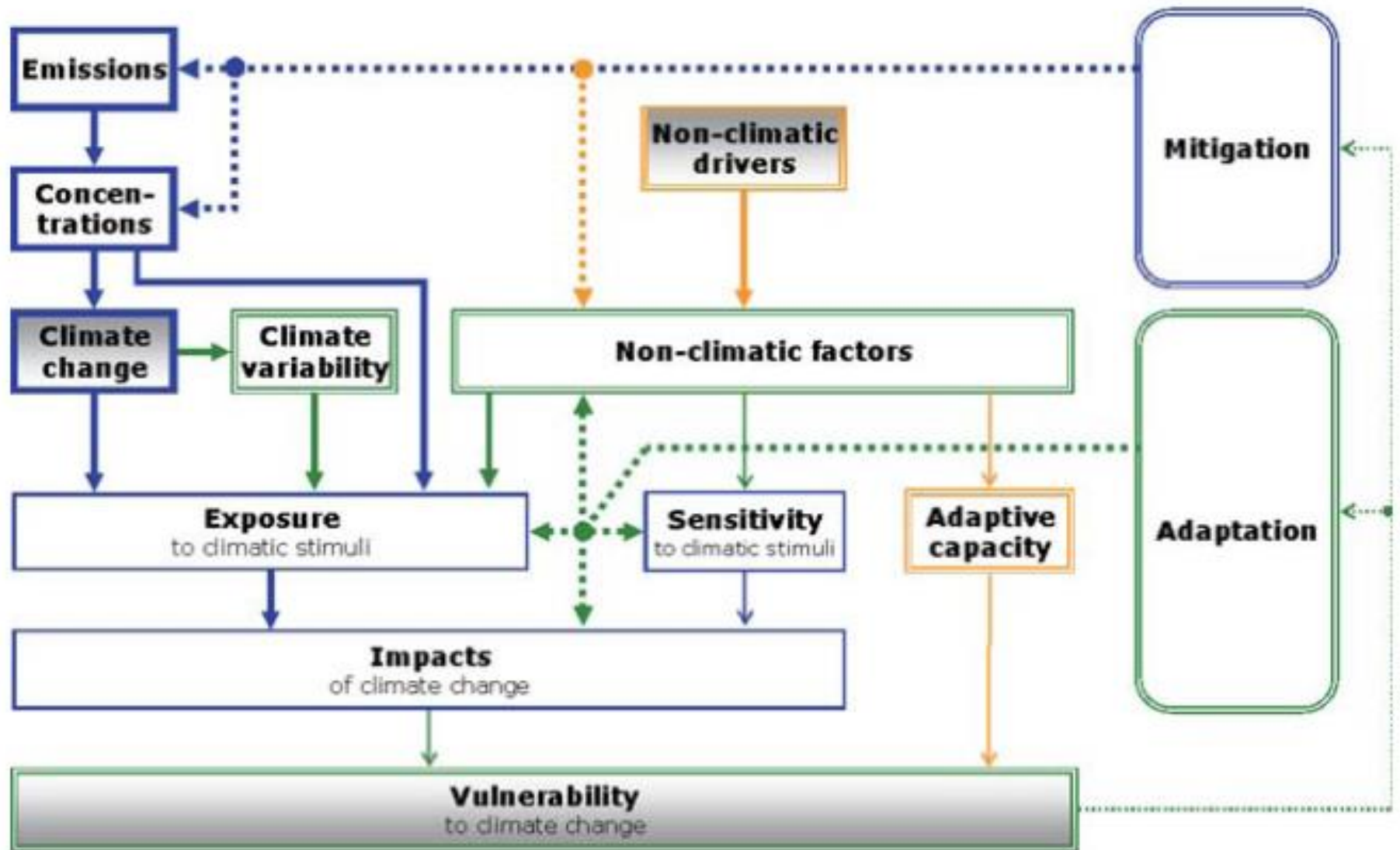
Population exposed to SLR and flood risks

Dasgupta, et al (2007) and on-going study at AIT

Major existing climate related hazards in SEA

Hazards	Characteristics
Coastal abrasion/ erosion	<ul style="list-style-type: none"> • Caused by flash floods, storm surges and SLR • Affects fishpond (mineralization), • Threatens infrastructure along coasts including roads and settlements
Drought	<ul style="list-style-type: none"> • Occurs during dry/summer months • Endangers crop productivity and catch yield • Strains city water supply
Flooding	<ul style="list-style-type: none"> • Most common hazard found in all of the study areas; • Caused by heavy precipitation, storms and typhoon (in case of flash floods); poor drainage systems; exacerbated by continued land subsidence due to over extraction of ground water
Sea level rise	<ul style="list-style-type: none"> • SLR already evident in some countries based on country level CC projects
Seawater intrusion	<ul style="list-style-type: none"> • Affects groundwater quality • Strains city water supply and infrastructure

Vulnerability assessment and Climate Management

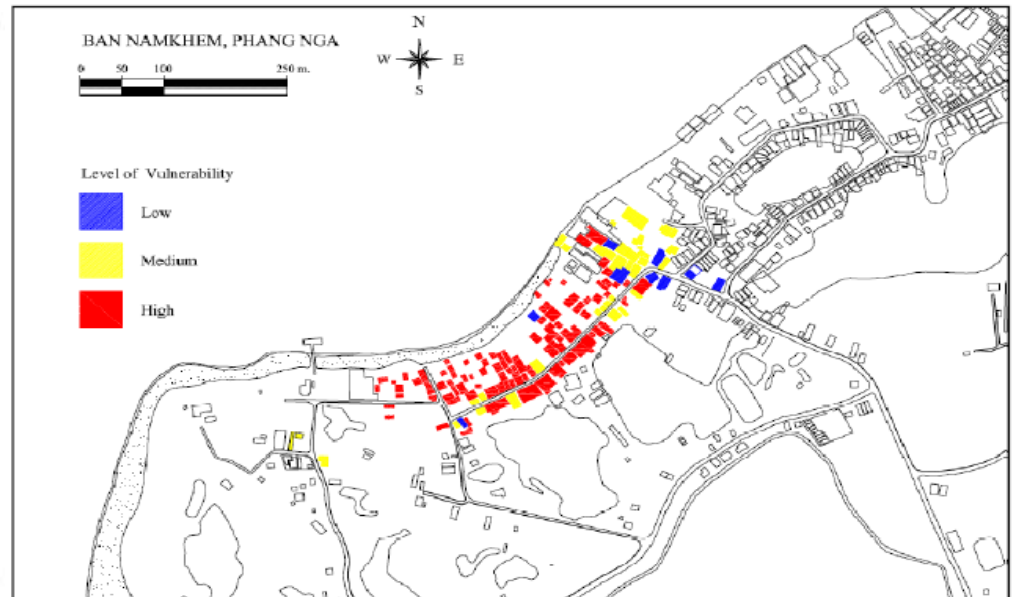


(Adopted from Fussler and Klein, 2006)



Figure 3.3: Namkhem Community Hazard Zone Map

Source: Modified from Ban Namkhem School



Vulnerability

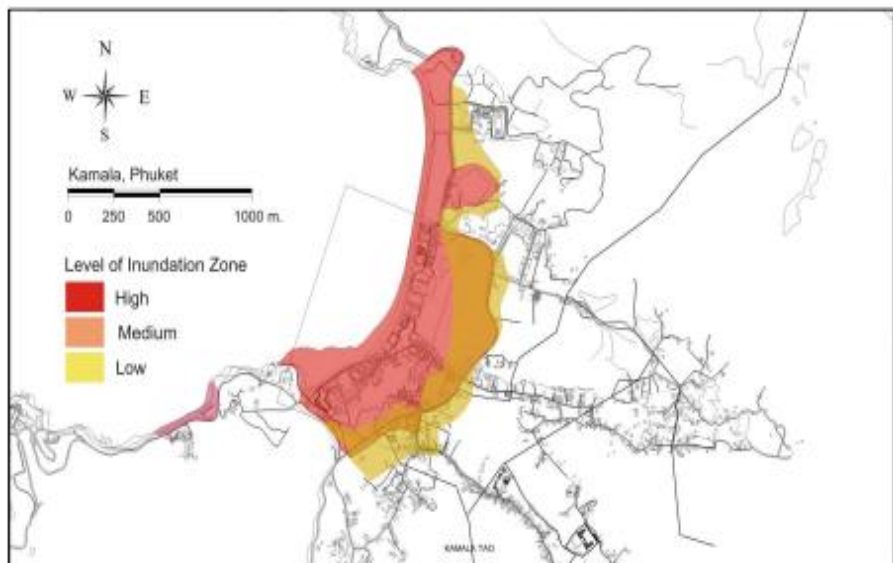
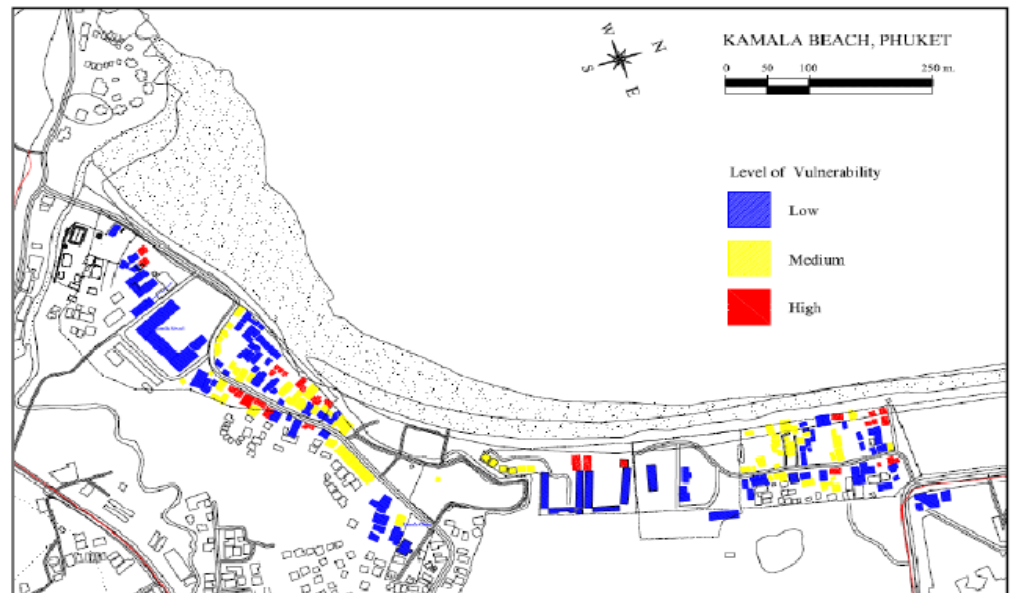


Figure 3.4: Kamala Community Hazard Zone Map

Source: Modified from Kamala TAO



Vulnerability and Adaptation to Climate Change for Water Management in Coastal Cities of Southeast Asia (ICI SEA Project)

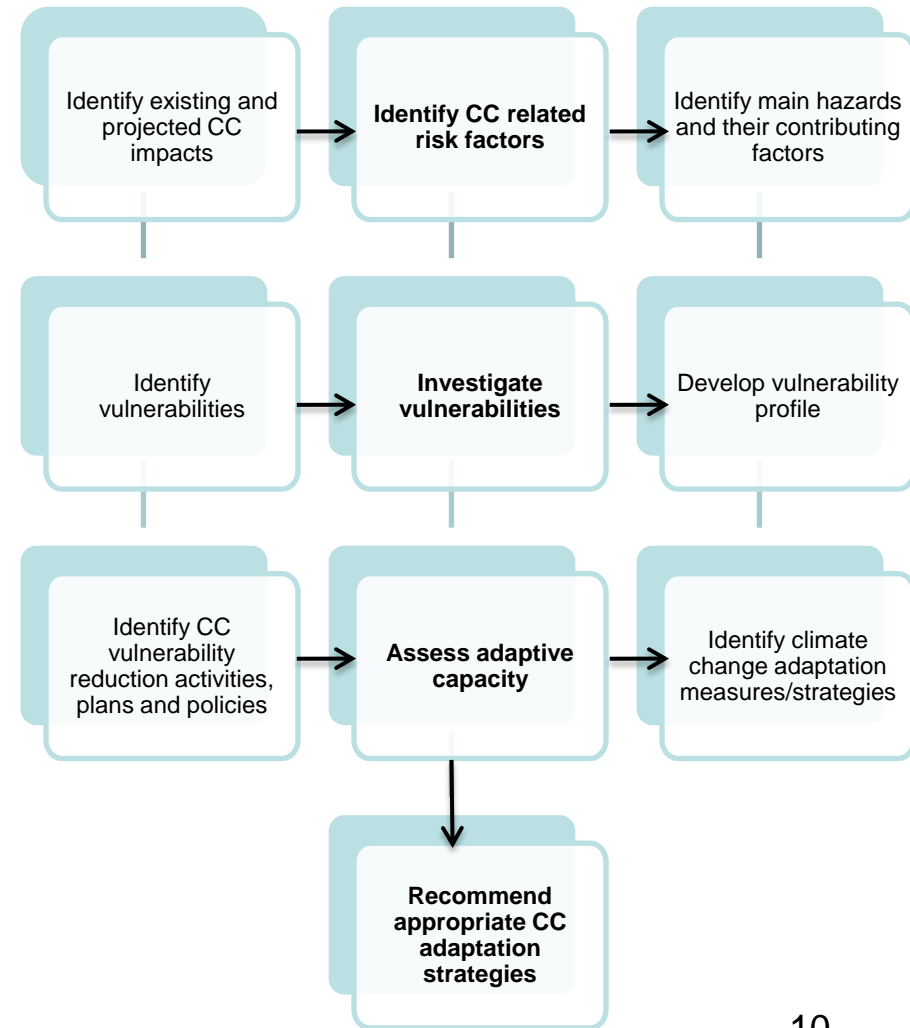
- Funded by the International Climate Initiative (ICI)
- Consists three phases and is set to achieve expected results over 4 years (2011-2014)
- **Objectives:**
 - Aims to enhance local adaptive capacities through learning from the cooperative research results on climate change impacts in Southeast Asian coastal cities
 - Aims to share the information and experiences on climate change risk assessment and adaptation related to urban water management based on research results and dissemination activities
 - Conducted at selected coastal cities in three countries of Southeast Asia, namely Indonesia, Thailand and Vietnam
- **Partners**
 - Urban and Regional Research Institute (URDI)
 - Chumchonchai Foundation (CTF)
 - HCM University of Technology (HCMUT)

ICI SEA Project (cont.)

- **Phase 1: Investigation** (*concluded*)
 - Review climate change vulnerability and risk assessment process
 - Study 15 cities of SEA countries on vulnerabilities and risks to CC related to water resource management
 - Conduct **rapid vulnerability assessment** in the 15 cities and select 2 pilot cities/towns in each country
- **Phase 2: Piloting** (*on going*)
 - CC risk assessment for water management on selected 6 cities
 - Evaluate efficacy of assessment methods/tools used
 - Implement pilot adaptation actions
- **Phase 3: Dissemination** (*planned*)
 - Publish and disseminate results through different media and learning nodes/networks
 - Develop CC adaptation guidelines/programs

Rapid Vulnerability Assessment (RVA) and the Framework for Urban Management

- a simple, quick, flexible, and generally inexpensive assessment tool often used to provide an understanding of constraints and facilitating factors that contributes to the vulnerability of population groups, with the use of both qualitative and quantitative data



PHASE 1: RESULTS OF RVA CONDUCTED ON 15 CITIES

Overall RVA Results

Country/ City	Vulnerability	Hazards						
		Storm	Floods	SLR	Saline intrusion	Drought	Coastal Erosion	Land Subsidence
Padang, Indonesia	Level	+	+++	+	+	+	++	•
	Most Vulnerable	Industry and Trade	Housing	Tourism	Agriculture	Urban water supply	Coastal housing & infrastructure	
Semarang, Indonesia	Level	+	++	+	++	+++	++	++
	Most Vulnerable	Fisheries; market and commercial areas	City core, coastal and riverine communities	-	Coastal communities; urban water supply	Urban water supply; agriculture	Coastal infrastructures	Residential areas in city core
Banjarmasin, Indonesia	Level	•	+++	++	•	•	+	+
	Most Vulnerable		Communities near river banks and on low lying areas	Communities on low lying areas			Housing; Infrastructure	Communities on low lying areas
Makassar, Indonesia	Level	++	+++	+++	+	•	+	++
	Most Vulnerable	Industry	Coastal and riverine communities	Coastal areas & small islands	Urban water supply		Coastal area housing & infrastructure	Urban population
Manokwari, Indonesia	Level	+	+++	++	++	+	++	•
	Most Vulnerable	-	Riverine communities	Coastal areas & small islands	Urban water supply	Agriculture	Coastal area housing & infrastructure	
Bangkok, Thailand	Level	•	+++	++	+	+	++	+++
	Most Vulnerable		Urban population near canals and rivers	Communities on low lying areas	Urban water supply	Urban water supply	Aquaculture farmers; coastal communities	Urban population; infrastructure
Phuket and nearby, Thailand	Level	+	++	+	++	+++	++	•
	Most Vulnerable	-	Coastal communities; urban poor	Aquaculture farmers; coastal communities	Urban water supply	Coastal communities; water supply	Aquaculture farmers; coastal communities	
Cha-Am City, Thailand	Level	++	+	++	+	•	+++	•
	Most Vulnerable	Farming and Aquaculture industries and livelihood	Housing near or along coastal areas; water supply	Housing near or along coastal areas	Agriculture		Housing; aquaculture farms; fishermen	
Rayong City, Thailand	Level	+	+	++	++	++	+++	+
	Most Vulnerable	-	-	Small scale fishermen; coastal communities	Agriculture	Manufacturing industry; agriculture	Small scale fishermen; coastal communities	-
Pattani City, Thailand	Level	++	++	+	+	•	++	•
	Most Vulnerable	Agriculture	Communities on low lying areas	Housing near or along coastal areas	Agriculture		Coastal communities; coastal infrastructures	

Overall Results (cont.)

Country/ City	Vulnerability	Hazards							Land slide	Erratic weather patter
		Storm	Floods	SLR	Saline intrusion	Drought	Coastal Erosion	Land Subsidence		
Ho Chi Minh City, Vietnam	Level	+	+	+	+	+	++	++		
	Most Vulnerable	Housing near or along coastal and river areas	Communities on low lying areas; urban transport	Housing near or along coastal areas	Urban water supply	Urban water supply	Housing; Infrastructure	Urban population; urban infrastructure		
Hoi An City, Vietnam	Level	++	+++	++	++	+++	+++	•	•	•
	Most Vulnerable	Housing near or along coastal areas	Road and transportation	Tourism	Agriculture	Water supply	Tourism; Cultural Heritage			
Nam Dinh City, Vietnam	Level	++	++	++	++	++	+	•	•	•
	Most Vulnerable	Housing near or along coastal areas	Housing; Agriculture	Aquaculture	Agriculture	Water supply	Housing; Infrastructure			
Quy Nhon City, Vietnam	Level	++	+	+	+	++	++	•	•	•
	Most Vulnerable	Settlements near or along estuaries	Settlements near or along estuaries	Urban infrastructure; water supply	Water resources for drinking and agriculture	Urban infrastructure; water supply	Tourism			
My Tho City, Vietnam	Level	++	+++	+++	+++	+	++	•	•	•
	Most Vulnerable	Housing near or along coastal and river areas	Aquaculture	Infrastructure	Water resources for drinking and agriculture	-	Housing; Infrastructure			

Major vulnerable sectors & groups

- Food security
- Housing and settlements
- Livelihood (Farming, fisheries and aquaculture)
- Tourism
- Trade
- Water supply
- Industries (Fishing, Farming and Manufacturing)
- Cultural heritage
- Road and transport infrastructure
- Households on low lying areas, such as those living near or along coastal and riverine areas
- Farming and fishing communities
- Water users
- Households with no access to piped or other sources of reliable water supply

Summary of Existing Adaptation Actions

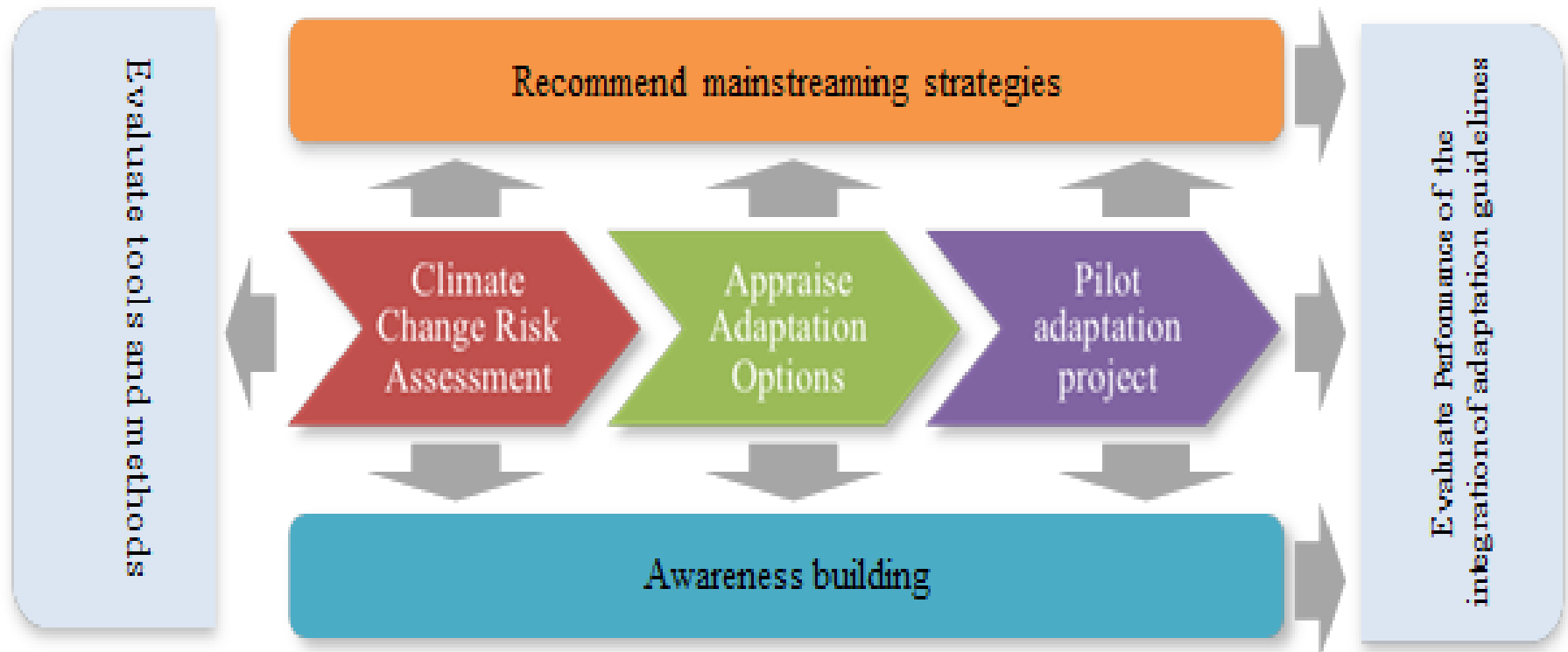
- **Structural flood protection:** polders and embankments, elevation of houses by landfilling, building houses on stilts, and/or building additional floors to take refuge during floods, structural improvement of riverbanks
- **Non-structural flood management :** disaster and emergency preparedness for communities flood, earthquake and tsunami prone areas, cleaning and dredging of water ways, improving solid waste management collection, relocation of illegal settlements along waterways
- **Mitigating coastal erosion:** breakwaters to ward off inland sea flow, mangrove reforestation , cribs and joints installation
- **Hazard sensitive land use planning and management**
- **Improving crop yields:** improved irrigation, crop rotation, flood and drought resilient crop varieties
- **Improving water supply:** water conservation, improvement of NRW

Major Findings

- Dearth of baseline and statistical data on many study areas
- Officials and residents can perceive what their problems are, but lack assessments yet on the long-term effects
- Confusion on what is happening arising from word usage and lack of information...
 - Is flooding caused by a) SLR? b) Tidal rise? c) Land subsidence? d) All of the above e) None of the above
- Local stakeholder knowledge and responses to CC issues also vary based on exposure to these issues
 - i.e., those who are exposed to other natural disasters are better informed and more 'welcoming'
- Anthropogenic activities are still not fully understood in the context of climate change
 - SLR/saline intrusion/drought on water supply & quality with over extraction & pollution
 - Flooding in relation to urbanization

PHASE 2: DETAILED RESULTS OF SELECTED CITIES

Operational Framework of Phase 2



Main CC related hazards

City	Hazard	Vulnerable group/sector
Padang, Indonesia	Flooding	Residents (northeastern area)
Manokwari, Indonesia	Storm surge	Coastal residents
Cha Am, Thailand	Coastal erosion	Climate sensitive livelihoods (e.g., farming, aquaculture, itinerant vending)
Phuket, Thailand	Water scarcity	Tourism industry, residents in far-flung areas
Ben Tre, Vietnam	Saline intrusion	Aquaculture, residents
Hoi An, Vietnam	Flooding and drought	Tourism industry, residents near or along river banks ¹⁹

Phuket, Thailand

- **Location:** Southern Thailand Region; Phuket Island
- **Coastal zone area:** Andaman Sea
- **Total land area:** 46 km²
- **Total population:** 101,170 (2011)
- **Study area:** Phuket Town and Rassada sub-district
- **Urbanization:** Small City with moderate rate of urbanization
- **Other features:** mangrove forests, several populated island districts, tourism as main income

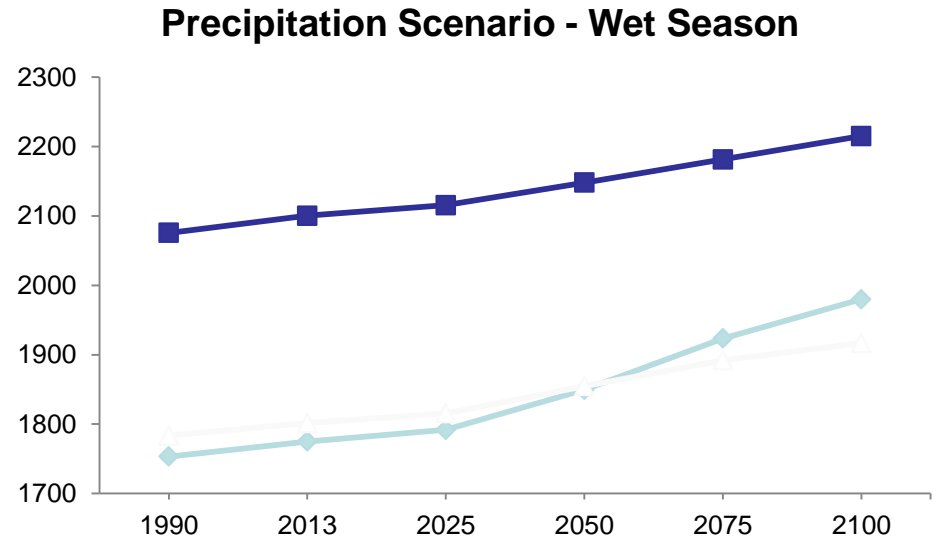
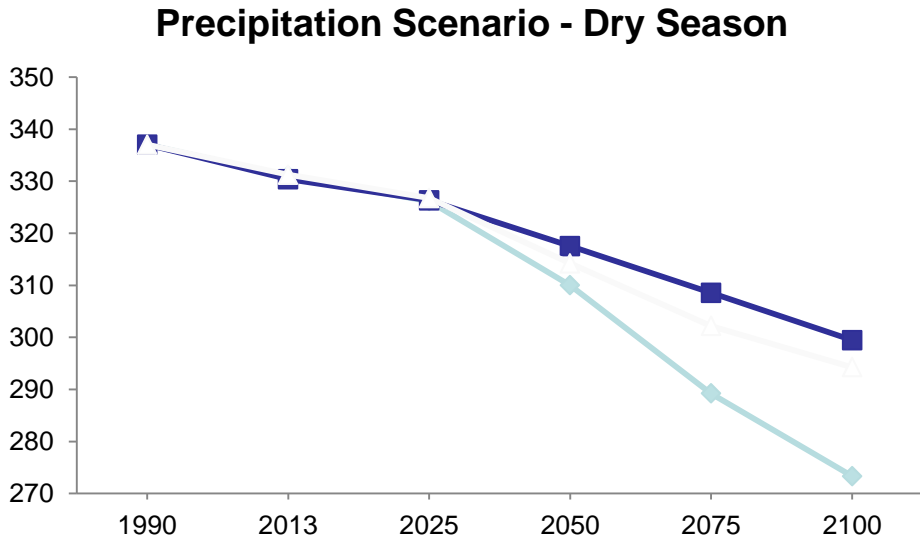
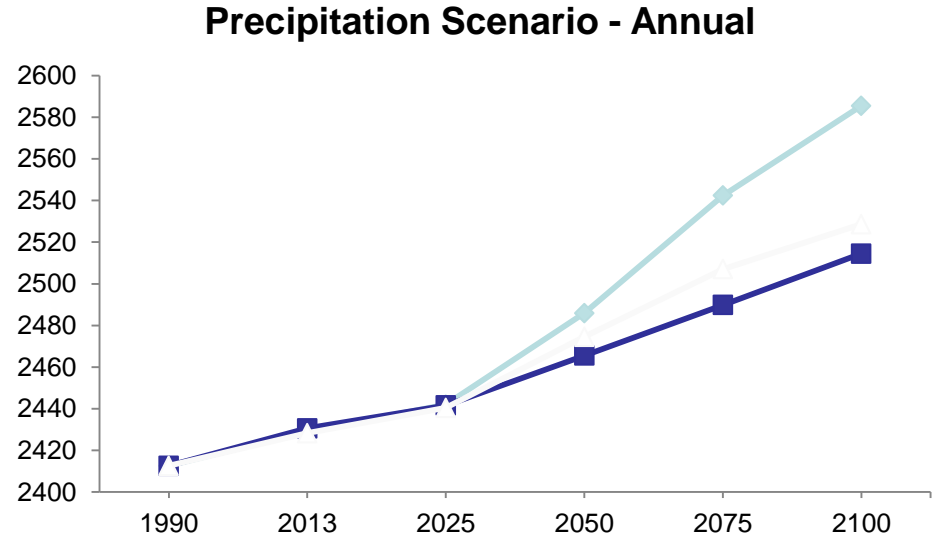
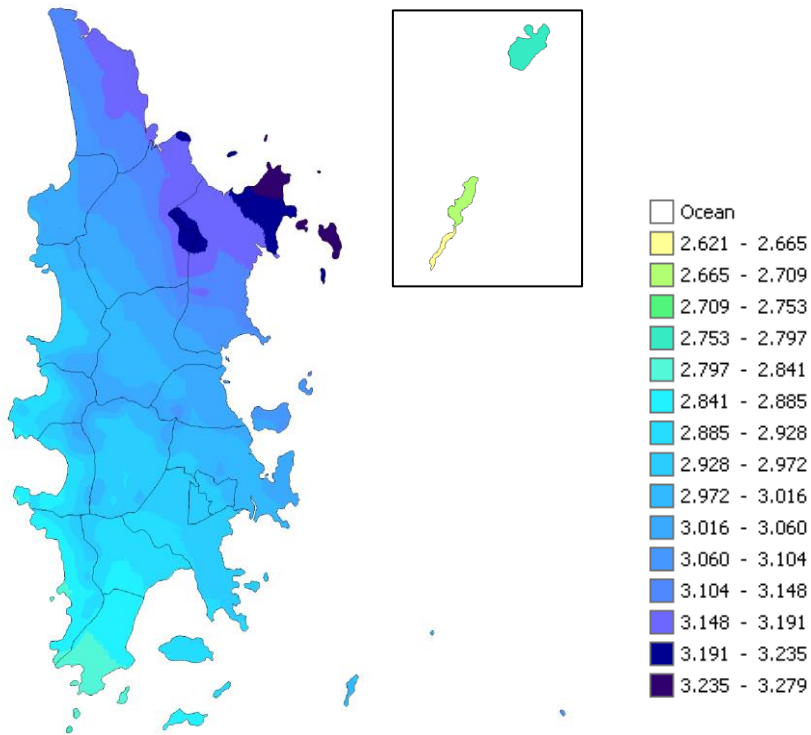


Vulnerable groups/sectors and their vulnerability levels

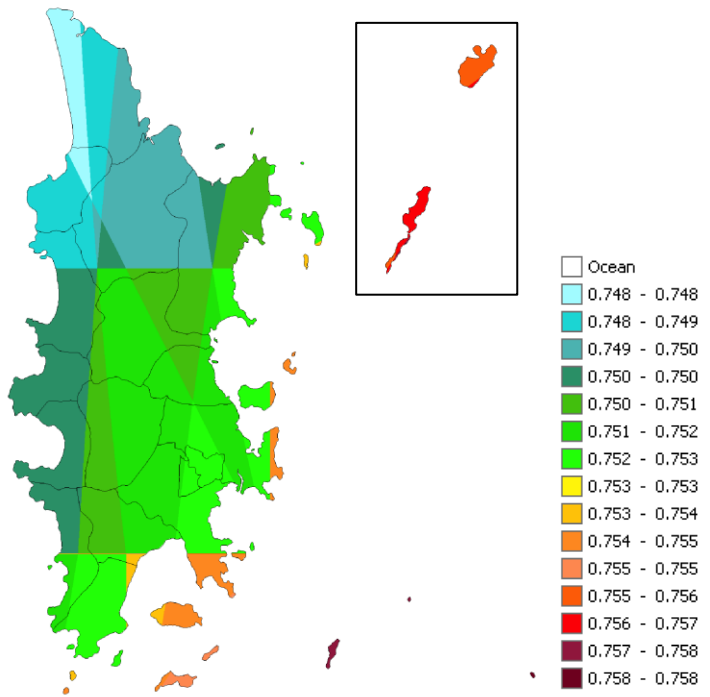
Vulnerable groups/sectors (Exposure units)	Climate related hazards		
	Flooding	Drought	Coastal erosion
Poor households in Rassada district	++	+++	+
Households along or near coastal areas	+	+	++
Aquaculture farmers	++	++	++
Crop farmers	+	++	•
Water supply services	+	+++	•

(Existing) Adaptation Strategies

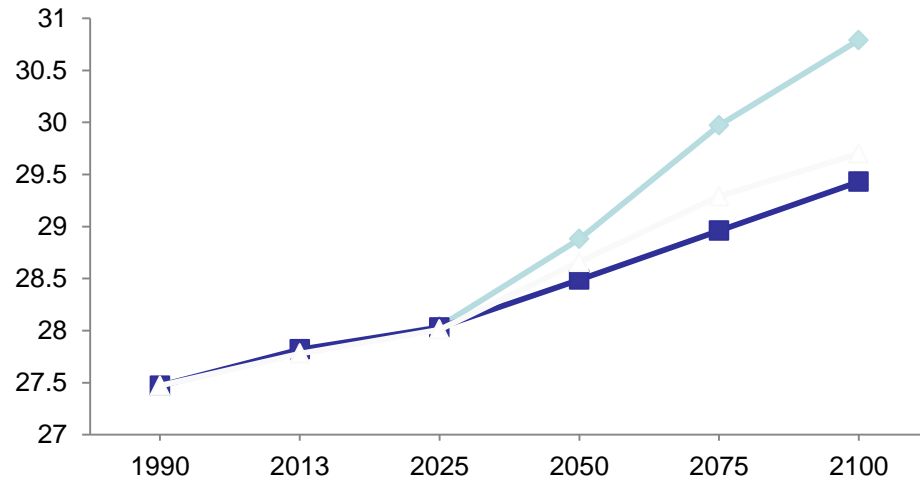
Hazard	Strategies
Drought	<ul style="list-style-type: none">• Plan for upgrading water supply systems and provide the water resource in each sub-district
Flooding	<ul style="list-style-type: none">• Plan to manage and improve the landscape along main canal (Klong Bangyai)• Build and improve the dyke for flooding and SLR protection• House upgrading: increasing level
Coastal erosion	<ul style="list-style-type: none">• Breakwater• Seawall• Groin• Sand Sausage• Beach Nourishment• Mangrove forestation



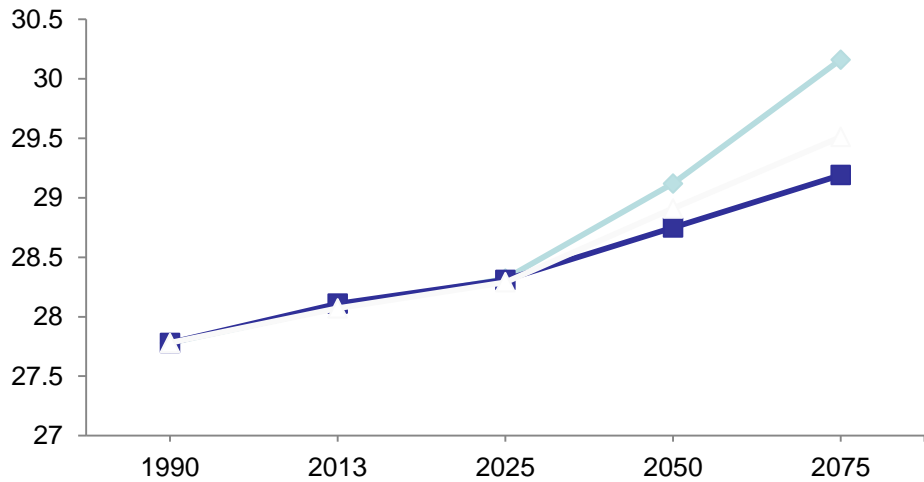
Legend — A1F1 — B2 — A1B



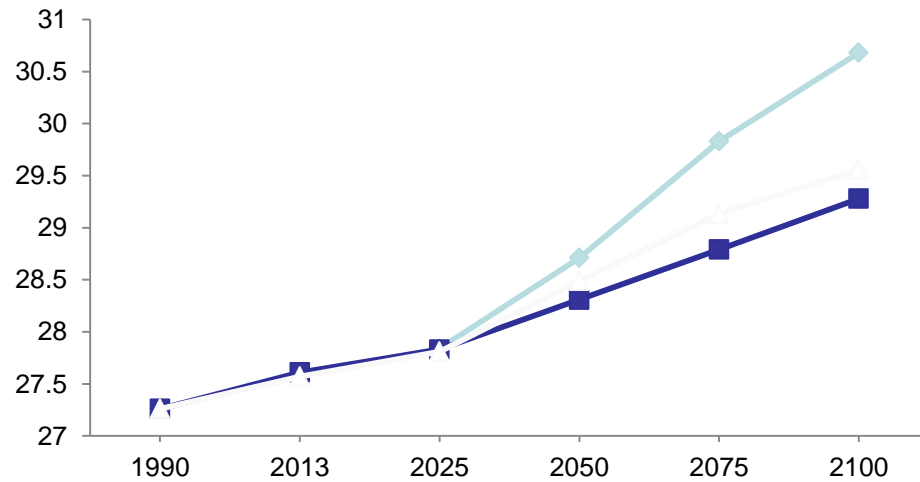
Temperature Scenario - Annual



Temperature Scenario - Dry Season



Temperature Scenario - Wet Season



Implications of Precipitation and Temperature Trend

- Drier dry season
 - increased incidence of drought/water shortage leading to crop failure, ground water supply scarcity, declining water quality
- Wetter wet season
 - increased incidence and magnitude of flooding, increased cases of water-borne diseases due to poor sanitation
- Hotter all throughout the year
 - potential impact to water supply, increased energy consumption (for cooling appliances)
- Changes in prec. and temp.
 - changes in other aspects e.g. soil erosion, drought period for agriculture, crop changes, flood changes, biodiversity changes, etc.
- Need significant concerted effort on water supply and sanitation, and flood management,
 - to mitigate impact of potential water shortage, flooding and overall city planning and development

City	Proposed adaptation strategies/actions
Manokwari	<ul style="list-style-type: none"> • Assessment should focus on flooding problem due to high tide and land conversion in upstream river area and coastal erosion due to increasing problems. • Mainstreaming of climate change risk management into local SWM plan; • Evaluate the long term impacts of coastal erosion to local water infrastructure and human settlements
Padang	<ul style="list-style-type: none"> • Assessment should focus on flooding and abrasion problem in specific location and its impacts on settlements. • Application of SEA to existing PPPs with the aim of improving land use and economic activities along the coastal area; • Technical capacity building on using climate modeling software for conducting probabilistic climate change risk assessments
Cha Am	<ul style="list-style-type: none"> • Evaluate the long term impacts of coastal erosion to local groundwater aquifer; • Develop climate change resilient urban infrastructure; • Institutional capacity strengthening and building for conducting climate change risk assessment
Phuket	<ul style="list-style-type: none"> • Develop alternative sources for water for drinking and other domestic uses for local communities; • Evaluate probabilistic climate risk on the island's local ground water aquifers and prescribe corrective and long-term adaptation actions; • Develop climate change resilient urban infrastructure considering both supply and demand sides; • Institutional capacity strengthening and building for conducting climate change risk assessment
Hoi An	<ul style="list-style-type: none"> • Strengthening cross-sectoral water governance; • Develop city plan for climate resilient tourism; • Institutional capacity building for conducting and mainstreaming climate change risk assessment • Assessment on Phase 2 should also focus on tourism due to the threat of SLR causing cultural heritage losses, urban infrastructure and water supply.



NEXT STEPS:

Piloting, dissemination and mainstreaming

Main Tasks

- Selection of pilot cities (*concluded*)
 - Padang, Manokwari, Cha-am, Phuket, Hoi An, and Ben Tre
- Climate change risk assessments using tools and methods based on local contexts (*on going*)
- Piloting of small scale adaptation project based on adaptation appraisal (also subject to availability of 3rd party funding)
- Evaluation of tools and methods used
- Dissemination of results and knowledge

Common barriers

- Funding for technical support and implementation
- Baseline information and tools (for proper assessment and adaptation planning)
- Focus more on gaps of existing disaster, with limited different types of adaptation
- Political will, interest and priority
- Sustaining the momentum of the adaptation projects (esp advocacies and international-supported programs)

Entry-points for successful buy-in

- Tie-ins with CSRs of big-name companies for adaptation projects
- Grassroots level engagement (targeting specific critically exposed communities)
- Champions (government and non-government)
- Co-benefits (with CC mitigation and/or basic development issues)

WE SHOULD WAIT
AND SEE IF CLIMATE CHANGE
IS HAPPENING BEFORE
WE DO ANYTHING



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Climate
is changing



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